

# **TQM** Volume-9

## **Total Quality Management** in Factory Management

### *PFMEA*

### *Process Failure Mode and Effect* *Analysis*

2025a Edition

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Factory Management Institute

COOPERATING TO REACH EXCELLENCE



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## Icons:



Notes: Going back to the central theme.



The third level of the Issue provides more clearness to the structure of the text to the more relevant.



Lower levels of the Issue, commonly 6<sup>th</sup> or 7<sup>th</sup>, and, pointing out necessary explanations about pictures or graphs.

## UPDATING TABLE:

Date, Version-Previous & V-Next	Chapter (I..XX...)	Chapter Point.- sub-point : (Updating)

## Summary:

The document "TQM-9 PFMEA" by Kouichi Kimura focuses on Total Quality Management (TQM) and Process Failure Mode and Effect Analysis (PFMEA). Kimura Sensei emphasizes mastering a few quality improvement techniques, particularly the QC 7 Tools, and highlights the importance of creativity and critical thinking in quality management. The document discusses the implementation of PFMEA in manufacturing processes, especially in new product development and plant construction, providing insights into practical applications, including the selection of candidate processes, preparation, and the use of Quality Control Process Diagrams (QCPD). It underscores the importance of building and maintaining quality even under extraordinary conditions.

The last chapter continues an example of *Jishu-ken*, autonomous study groups within organizations focused on continuous improvement and problem-solving. It emphasizes creativity and critical thinking in quality management and highlights the practical application of PFMEA in manufacturing processes. The chapter includes a dialogue between the author and a director responsible for the Engineering and Quality department, discussing PFMEA implementation and the importance of creativity in quality analysis.

Annex A, originally written in Japanese, discusses JI-KOUTEI-KANKETSU, which focuses on completing each process step with quality. It emphasizes ensuring each manufacturing step is completed correctly before proceeding and is closely connected to the last chapter's discussion on Jishu-ken. The annex provides practical examples and preparation steps for implementing JI-KOUTEI-KANKETSU, highlighting creativity and critical thinking in quality management.

# I. Prologue

I'm writing TQM (Total Quality Management), and I'm now doing it through the New QC 7 Tools.

Please listen there are so many quality improvement techniques, including QC 7 Tools in SQC, New QC 7 Tools, FMEA, and Six Sigma. Are all these necessary to improve quality? Of course not.

I'm an expert in TQM and have worked for many years. I know many techniques, including FMEA, 6 Sigma, and the New QC 7 Tools. A book tells us that just the fundamental QC techniques can resolve more than 90% of quality troubles. Based on my experience, most quality troubles can be resolved with just QC 7 Tools in Statistical Quality Control.

Knowing many things but using a limited technique... In fact, it is sufficient for your company's problem-solving by just (for instance) QC 7 Tools. But one thing, please master and make full use of a few techniques. Please you to be a *Tatsujin* of one or two techniques. I'm a *Tatsujin* of KJ.

There is a next word: “一理に達すれば万法に通ず”:

- 一理 (Ichiri): One principle;
- 達すれば (Tassureba): Reach or lead;
- 万法 (Banpou): All things or principle;
- 通ず (Tsuzu): Understanding or applying .

*"Understanding one principle leads to understanding all things."*



Figure 1 Miyamoto Musashi  
in Wikipedia

This is the word of **Gorin-no-sho** by Musashi Miyamoto<sup>1</sup>: “This means that mastering one technique or art leads to mastering many other techniques and arts.” This idea is accepted as a universal truth that can be applied to martial arts and many other fields.

I like this word. And I suggest you become *Tatsujin* using one QC technique.

And what do you think? Are these still necessary? ...Of course, it is essential to provide a fundamental management base, including project management.

In here, I wrote about FMEA. However, including the FMEA as a QC technique is unnecessary. Please, you don't become to be a Tool Fool. Instead, I suggest you be a *Tatsujin* of the QC 7 Tools. However, the New QC 7 Tools? ...I think it is not necessary.

I'm a *Tatsujin* of KJ, as well. I use it as a tool of creativity in any case. And, nowadays, a power of imagination is required in any case. 5-Whys? Fish Bone? QFD (Quality Function Deployment)? Kaizen? Product development? Anyway, the power of thinking and creativity are fundamental.

I hope you are becoming a *Tatsujin* in one technique rather than Intellectuals of many techniques:

- *Tatsujin*: "Master" refers to someone who excels in a particular skill or knowledge.

<sup>1</sup> [https://es.wikipedia.org/wiki/Miyamoto\\_Musashi](https://es.wikipedia.org/wiki/Miyamoto_Musashi)

For example, it often refers to someone with exceptional abilities in a particular field, such as a kendo master or a cooking master.



## II. PFMEA - Process Failure Mode and Effects Analysis

### PFMEA as one of the QC 7 Tools?

I'm writing New QC 7 Tools. I wrote an Arrow diagram based on a company's story in the last issue. This time, I'm continuing this company's story.

I suggested that PFMEA should be used in the Arrow-diagram's progress. However, I omitted the detailed writing because of the constraints of the number of pages. I need to tell the true story...

Recommend FMEA in Arrow diagram activity? ...No, in fact, it wasn't. (??? It may be your image.)

Actually, I suggested doing PPM - Potential Problem Map, as part of IPQC (Initial Products Quality Control) for this new products series by the new plant. The truth was that Mr. Ge (One of the directors responsible for the Engineering and Quality department) requested that he implement FMEA rather than an unknown method called PPM. Below it is the dialogue:

—Sensei —Asked Mr. Ge,—, What is PPM? ...I don't know such a concept. Rather than such an unknown and uncertain technique, I wish to implement FMEA. I agree with you about making a quality analysis in the Arrow Diagram activity.

—The combination of quality analysis and process analysis —he continued—. Arrow diagram activity is one kind of process analysis. Therefore, we can't afford to miss such a great opportunity. PMM? I think it is ridiculous.

—Mr. Ge, —I answered—. FMEA or, at this time PFMEA. Do you understand what is most important factor?

Cutting off my word continuation he expressed: —I'm an expert of 6-Sigma, and have its more profound knowledge. I know the steps of FMEA.

I, actually, did not enhance his speech on this matter.

—Once again —I tried to ignore what I found to be a very long speech—; the most critical factor is "Creativity: Coming up with the idea, Creative Thinking."

—Ok, Ok, Ok! —he admitted.

—I understand Mr. 6 Sigma. Let's implement PFMEA at this time. The PPM task will be given to the IPQC team. And let's compare DFMEA (Design FMEA) and PPM. In a textbook, it is also suggested that PFMEA be implemented in the Arrow diagram activity. Let's do PFMEA. OK?

Again, it is not time now to continue describing any other further dialogue.

He is an expert of 6 Sigma (top-down type activity) and wishes to implement companywide improved reliability activity by 6 Sigma.

I'm an expert in TQM, and I wished to implement improved reliability by 3-dimensional activity, which are Organization improvement, KPIs, and **Gemba-Ryoku**<sup>2</sup>.

I would rather expose the issue in a different direction. My TQM never denied that the 6-Sigma activity is a Top-down activity. TQM also sometimes uses such a Top-down style by special projects. But I (maybe CP also) thought the temporal improvement by 6 Sigma was probably a castle in the sand. Anyway, we just don't get along.

There was such dialogue with Mr. Ge. However, I thought it was not bad to explain FMEA to them. Then, I continued to write this theme. We know that FMEA is not one of the New QC 7 Tools. However, before going ahead, I wrote a little after that of KJ Arrow diagram making.

- 1 The original construction schedule; Couldn't be kept.  
But 13 days delay by complex negotiation to relevant companies.
- 2 New products were introduced and started; it was made as planned.  
However, the initial start was used as a subcontracting process (press process).
- 3 Cost: Almost the planned investment was kept.  
The cancellation of 2 press machines affected keeping the planned investment.  
(Also, negotiation with the relevant construction companies. Rationalization of the construction process.) (Firing Chairperson and General manager of engineering was avoided.)
- 4 Items added: 8 items. (5 were by PFMEA)

Based on the KJ Arrow Diagram, the regular follow-up conference was held. The construction schedule and work were well managed.

## PFMEA (Process FMEA)

This group implemented PFMEA in the process of the KJ Arrow diagram. As above, 5 items were added to the diagram. I omit to explain all but explain PFMEA with one example.

First of all, what is PFMEA? ...Since this is a hassle, I'll show you the answer from Copilot.

**Prompt: What is Process FMEA?**

*Process FMEA (Failure Mode and Effects Analysis) is a risk management technique used in manufacturing and process management. It involves identifying potential failure modes in products or manufacturing processes, evaluating their impact, and implementing preventive measures. Let's break it down:*

1. *Definition: FMEA stands for Failure Mode and Effects Analysis. It helps anticipate and prevent failures or issues related to products or processes by analyzing their potential failure modes.*
2. *Failure Modes: These are conditions where a product or process does not perform as expected. They can result from defects, malfunctions, or other issues.*

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<sup>2</sup> **Gemba-Ryoku**: Capacity or Capability of the Gemba to be able to regenerate by itself or self-improve the previous condition.

### 3. Application:

- a. *Process FMEA (PFMEA): Specifically applied to manufacturing processes, PFMEA focuses on identifying potential failures within the process itself. It aims to prevent errors, improve quality, and enhance reliability.*
- b. *Design FMEA (DFMEA): Used during product design and development, DFMEA identifies failure modes related to the product's components or units.*
- c. *Function FMEA: Part of DFMEA, it assesses the functionality of hardware or software components.*

### 4. Importance of Process FMEA:

- a. *Ensures quality by addressing potential abnormalities.*
- b. *Helps prevent common patterns of trouble.*
- c. *Enhances safety, quality, and reliability.*
- d. *Requires proper management and systemization.*

*Remember, FMEA is a valuable tool for maintaining quality and preventing issues in manufacturing processes. If you need more detailed information, feel free to ask!*

**MS-COPILOT ANSWER (Nov-2024)**

What a convenient tool it is! It is excellent for cutting corners in my writing. However, please be careful. Sometimes, AI tells a lie. Above comment by Copilot, there is no mistake, maybe.

However, is implementing PFMEA in an Arrow diagram common? ...I don't know because I haven't seen such a case. In the first place, large Arrow diagrams such as this company were my first experience, and I also haven't seen it. According to the literature, there has been a thought of using PFMEA in an arrow diagram for many years, but I haven't seen it either.

At this time, I have strongly requested the implementation of PPM (but PFMEA) in the Arrow diagram (of the construction scheduling) activity (even though this job was out of contract).

There were some reasons: One reason is that it was outside my current contract. (But I ended up taking it as things go.) Another is my time limit.



## The Arrow Diagram.

It is necessary to break down the process in the diagram (process analysis).

### Break down the process and process analysis.

It is very much good opportunity to implement such PFMEA. There is no reason not to do it.

This company had his quality management system (and good 6 Sigma manager: Mr.Ge). However, the result was not favourable. Additionally, new plant construction, new products line up. The initial contract was (one again) TQM teaching. And the objectives were current products and current plants (2 plants).

The contents of teaching TQM in Factory Management were SQC (Statistical Quality Control), Management organization (KPIs, Management Team Establishment, Regular Meeting system, Project leading), Gemba Ryoku Improvement (Gemba Committees: Kaizen committee, Safety Committee and 5Ss Establishment).

Simply: My style of teaching is from 3 dimensional:

- One is **Management Kata** establishment.
- Another one is **Management by Data**.
- The last one is **Gemba capacity improvement**.

Now, the requirement was very sudden. CP (Chairperson) invited me to a conference. (Initially, he looked proud.) The conference was the regular conference on new plant construction. As I wrote in the previous issue, it was a very sudden request.

During the conference, I was thinking about what I should do regarding the new plant construction and the start of the new product line-up. I have two subjects to cover: 1—Construction schedule (to shorten LT, Reduce Costs, and establish Quality). 2—New product introduction (the technique of IPQC; Initial Products Quality Control).



**3H - Most quality unstable period I call is 3H: *Hajimete, Henkou and Hisasiburi*.**

1. **Hajimete:** First experience. Completely new products and has no experience.
2. **Henkou:** Change. Design change.
3. **Hisasiburi:** After a long while.

IPQC<sup>3</sup>: The initial product is of the most unstable quality. IPQC aims to manage the quality of such initial products produced by a project and committee activity.

Let's look at the occasion of defect occurrence from production Gemba. These are "extraordinary, non-routine, and abnormal" conditions. We must ensure that quality is maintained even in these conditions. I needed to implement these by adding the above TQM teaching.

However, this story will continue with the following issues.

I schemed to establish the quality of new products by establishing a new plant and another project (IPQC).

After the conference, which triggered my involvement in the new plant construction, I requested to set up one new project. It was the IPQC project, attended by all departments. (I will write about this activity from now on.)

<sup>3</sup> IPQC can be assimilated to APQP perspective: [Eng]  
[https://en.wikipedia.org/wiki/Advanced\\_product\\_quality\\_planning](https://en.wikipedia.org/wiki/Advanced_product_quality_planning)



## “Building quality into the process.”

Considering this: this is a good opportunity to build quality into the process and the new plant construction.

Product FMEA should be considered in the IPQC activity. And the Process FMEA can be regarded as in the Arrow Diagram of new plant construction.

Is PFMEA for just new product development? ...No, it is not. Process Failure Mode and Effects Analysis (PFMEA) is also used for existing products.

It's an analytical method that helps identify risks in the manufacturing process and prevent potential defects or failures. By quantifying the impact of factors, PFMEA prioritizes high-risk areas for targeted improvements, ultimately enhancing efficiency and quality.

Unlike Design FMEA (DFMEA), which focuses on product design, PFMEA specifically addresses risks during the manufacturing process.

However, I intended to use it for new products and production lines. The introduction was long, but now I will get to the main point. It is very simple and easy. Let's look at one example.

After all, I explain the background.



## PFMEA example

This new product series involves assembling a Switch set into a case. This switch set is produced by a sister company. The latest product series is completed by assembling other parts made in-house and this switch case.

Ejemplo de PFMEA

N°	Proceso y Trabajo	Modo de Falla	Causa de Falla y Mecanismo	F	Posibles causas	G	Evaluación				Medidas		
							P	D	O		Defecto	Proceso	
1	Assembling the switch set into the main body case	Electrode deformation when assembled	When assembling the electrode part touches the case and is deformed. The electrode part does not come into contact.	3	When inserting the case the electrodes cannot be seen, so assembly is made by feel.	5	3	5	15			Jig & Tool development	FE
			The switch set was installed backwards. The electrodes were in contact with the case, causing deformation. The electrodes were not in contact.	2	Prevention of reverse assembly depends on the operator's attention.	5	2	5	10	POKAYOKE Mark by Color in case	DE		
			When removing the SWITCH set from the parts box, the electrodes may be hit against the corners of the parts box, causing them to deform and prevent the electrodes from contacting each other.	3	Removal of the SWITCH set relies on the operator's attention.	3	3	3	9			Standardization and indication of electrode storage direction.	Pur
2	omit	omit	omit	omit	omit								
3	omit	omit	omit	omit	omit								

Why was this assembly process chosen? ...In fact, it is not realistic to build up PFMEA for all processes, because of so many processes in the KJ Arrow diagram. Therefore, it is necessary to choose the candidates of PFMEA implementation. (The meaning of candidate is the potential quality risky processes; “high-risk areas for targeted improvements”.) Let's look at the process...

### Choosing the candidate processes in Arrow diagram.

All project member discussing the quality worried process and vote. Office staffs haven't the engineering, quality skills. But their voice is important as the voice of users. Therefore, engineering, quality persons are required the polite explanation about the parts composition, function, (for instance) assembly methods, machines, tools and necessary skills. To vote, I use the 5, 3, 1 count: 5: Risky. 3: Fairly risk. 1: Low risk. And use 4 and 2.

### Preparation for FMEA

1. Engineering visual data. Prototype (If possible). Component parts (If possible). Design drawings. Quality data of similar products (If possible). Voice of customer by sales department (about QCD; Quality, Cost and Delivery). Customer's needs. Photo of machineries. Assumed process and pictures. (Simply making up the QCPD).
2. Simple QCPD (QC Process Diagram) making for candidate process.
3. 2nd Vote and decide the candidate processes with the evaluation table below by card.



### QCPD - Quality Control Process Diagram<sup>4</sup>

**DIAGRAMA DE P.C.C.**

Producto: \_\_\_\_\_  
Nº de Diseño: \_\_\_\_\_  
Fecha: \_\_\_\_\_

Nº	1	2	3	4	5	6	7
Nombre de Proceso							
Artículo							
Foto de Proceso							
Trabajo							
Punto de Calidad							
Especificación							
Método de Inspección							
Herramientas de Inspección							
Anotación							

**DPCC: PRENSA**

Nº	1	2	3	4	5	6	7
1. Identificación del proceso							
2. Descripción del proceso							
3. Descripción de los recursos							
4. Descripción de los materiales							
5. Descripción de los métodos							
6. Descripción de los equipos							
7. Descripción de los recursos humanos							

¿Columnas distintas?  
Si y depende de la ocasión  
modifica.


I omit the detailed explanation but introduce the image (in Spanish). You can design a different one with different columns, just in case. The above picture is not the company

<sup>4</sup> **Quality Control Process Diagram or Chart** [QC工程図] In the APQP VDA/IAG perspective, this kind of chart or diagram is used in the APQP – CONTROL PLAN. This format is described in the Annex A of the ISO/TS16949.



I'm writing about, but it is different. It is only an example of an excellent team. I will describe the details of QCPD in a later series.

**Frame of Diagram:**




Process Analysis

## Process Analysis

In this case, we also make the QCPD. It depends on the target and time and is focused on the manufacturing process.

Now we can see the process in both **Production-Genba** (working in the workshop and press) and **Office-Genba** (reception and treatment of the work in the Technical office)




Write down the process in the Diagram

The **Quality Control Process Diagram** (QCPD) for Office-Genba and Production-Genba is in the same format. We can adapt the format and the columns depending on the specific requirements of the process pictures, Standard conditions around the process (5S+4R), Safety, Quality, etc.

The pictures represent the work analysis of the **Office-Genba** or the Technical office. They can also be edited on the computer.

QCPD is also part of the Control Phase of the PDCA cycle.



**Columns structuring Process: (*Office-Genba* work)**  
→ *Part reception work at the Technical office:*

In this case, the reception process did not include the quality control reception process: Control at arrival and reception process.

In the QCPD we include both in the arrival process: Arrival process and Quality control process. This process is described in 6-7 different methods, only at reception.

To improve the ***Office-Genba*** process, making a flow process diagram is a normal procedure CPD. By (1) collecting all the steps in Post-its and pictures and assigning a number to everyone, (2) assigning a Name, (3) Annotating the description of the process in the Diagram, (4) Describing the point of quality and standard of validating the step, (5) Method and Tool used for inspection of the quality and defect listing and pictures. (6) Safety can be also another point for control. (7) A checklist can be added as well.

In this QCPD for the ***Office-Genba***, not all the columns (1..7) are required. For instance, the “Tool of inspection” cannot be defined in many works at the Technical Office. However, the quality of the step can be defined in some or other way, for instance, using checklists.

[illegible]

## Their work completed

Going back to the company I was teaching: The Above picture example is a case of existing products. But the company's case I'm writing is of brand-new products.

Is it possible to use the same method? ...Of course, yes. And it is entirely the same process.

- **Manufacturing process:** It is already assumed and confirmed in the Arrow Diagram and is very easy.
- **Photos:** Use the prototype and the parts, pictures, design drawings, or similar product process photos.
- **Vertical Items:** Photo, Work, Quality point, Specification, Inspection method, Inspection tool, Note. These are the works of the engineering and quality department. Current ideas should be included. Then, Gemba workers' thoughts are added.

Difficult work (making this diagram)? ...No, no. Not at all. And how easy is it? ...For instance, you can see a QCPD (DPCC in Spanish) in the next photo. This is one chart of a QC circle and the group member of Gemba operators.

They made this an enjoyable and effortless task because they knew the production process. Easy? ...it is indeed easy to make this diagram, but it still requires much work.







***IPQC is a serious job, and it needs the company-wide resources***

*Do you remember me establishing the other three groups written in the last column?*

*One group activity was IPQC (Initial Products Quality Control). In this activity, I requested a small sub-group activity to make the QCPD for the new product series that will be made in this new plant. Of course, this group is out of the Arrow Diagram team.*

*When I attended the grand meeting for new plant construction, the CP (Chairperson) asked me to help resolve a serious situation.*

*At that time, I requested CP "Company-wide all-out war." This meant using companywide resources, and it meant using capacity for the new plant and the manufacturing process.*

*Is it complicated? ...The initial contract between me and this company was just plants 1 and 2, and the objective product was the existing products. And additionally, plant 3 construction and new series products were added to the new contract.*

*At that time, the person in question (Mr. Ge) didn't understand these heavy resource requirements.*

*IPQC project. I will describe this detail in another issue. But simply now: Members of this project are all departments, including office departments (HR,*

*Accountancy, General Affairs), Sales, Engineering (including Design, Production, Quality, Maintenance), and Gemba departments (Production, Warehouse, Purchase, Material Control, Production Planning, Outsourcing). Anyway, all departments are involved.*

*When I required the candidates for these departments, managers quickly filed a complaint, and everyone spoke simultaneously.*

*I had imagined the claims, but I was fed up. In fact, my first and most difficult job is always negotiating with managers. Because all Kaizen or innovation is made by their people, this negotiation is essential for getting these resources.*

*If the negotiation is deadlocked, I'll end it right away. I'm terminating my work in the company. Implementing IPQC was my first experience in this company.*

*I negotiated them and explained next.*

- 1. It is the "golden opportunity" to establish good QCDS+3Ss (Quality, Cost, Delivery, and Safety + Customers' Satisfaction, Employees' Satisfaction, and Society's Satisfaction).*
- 2. Because. The opportunity of (New Plant construction), New products introduction.*
- 3. The fundamental principle is "all people's participation." All people are requested to think QCDS & 3Ss through the new products' introduction based on their experience and standing position.*
- 4. IPQC technique. Either way, I need to teach this technique in the current contract in Plant 1 or 2. The introduction of a new plant and new products is a very convenient opportunity.*

*And calling to everyone: —New products, new designs, new production methods, new machines and tools...*

*—Listen everyone —I called, again, their whole attention—. In Japan, there is a proverb about buying a new vehicle: "Never buy the car of the first product lot." It is indeed the unstable quality of the initial products. Therefore, the technique and activity of IPQC is essential.*

*Anyway, the QCPD in IPQC activity was implemented.*

## **The story of PFMEA (Process FMEA)**

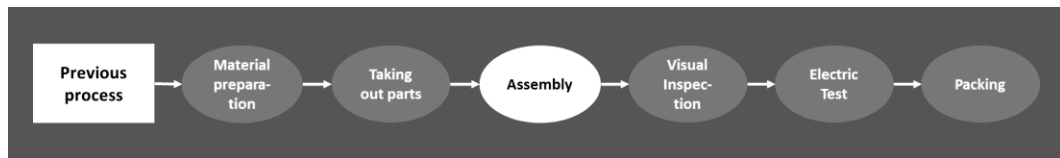
In front of the QCPDs, the Arrow Diagram team and the QCPD team held a grand meeting to vote on and decide the PFMEA candidate process.

And, voting to choose process candidates is made 2 times.

One is the Grand candidates (temporary names that I used to identify them) from the processes of the Arrow diagram. Another is the Narrowed-down candidates (temporary, as well) from the above Grand candidates.

For instance.

**Process in Arrow Diagram:** The switch case assembly process uses the following processes:



This group chose the Assembly process in the above Arrow diagram as the Grand Candidate (temporary name) by voting with 5, 3, 1 count.

The assembly process above has 13 processes, as shown below.

- Switch case taking off from packaging.
- Wiring harness taking off from the parts box.
- ...
- Assembling the Switch set in the main body case.
- ...

By voting, they chose the process of "Assembling the Switch set in the main body case" as the narrowed-down candidate.

1. Making QCPD (Making QCPD is recommendable, but you can omit it.) The QCPD team made the presentation with an Overhead Projector and large handmade charts. Based on their experiences (about employee training, machines and tools, working methods, materials, and safety), they chose 13 quality anxious processes. Then, they made QCPD for these anxious processes. (13 processes? Sufficient? I don't know. But they chose these.)
2. Narrow down candidate: It is necessary to choose the candidates (Narrow down candidate) for PFMEA. It is not realistic to make PFMEA for all processes. Therefore, it is necessary to narrow down candidates. For instance, they made 13 QCPD. If 13 diagrams have each 10 processes, the number of PFMEA is  $13 \times 10 = 130$ . In practical terms, it is not necessary to make all.



### **QCPD (briefly)**

The **vertical** items of QCPD are (from above to bottom) Photos, Work contents, Point of attention (for quality), Specification, Inspection method, Inspection tool (and quality defect history).

**Horizontal** axis. Process number, Process name and Photos or pictures.

*I will introduce QCPD details in another issue later. In effect, the possible quality control method and procedure are discussed in the QCPD activity. So, how does choosing the*

*candidates process in QCPD? ...By no taking so much time: By inspiration and voting. Inspiration!? Yes, inspiration. But... For voting. It is used a special evaluation table.*

*Evaluation table, it is one of essential factor for FMEA.*

- Critical process as the product.
- Defect detection method by not reliable detector or by human attention.

For instance: This process No.5  
The defect detection method is "Visual" inspection.  
And also, it has no inspection tool.

If this is a critical process as this product, this process should be a candidate of PFMEA.

DPCC: PRENSA							
N°	1	2	3	4	5	6	7
NOMBRE ITEM	Selección de matriz y accesorios	Limpieza y lubricación	Montaje de mordaza	Colocación de anillo	Presar	Corte automático por presión	Medición de producto
FoToS							
TRABAJO	- Selección de accesorios - Configuración prensa	- Eliminar impurezas - Lubricación del tubo	- Colocación de mordaza en el tubo	- Colocación de anillo según habilita Portmap 2	- Mordaza centrada - Quitar mordaza sin forzar - Avanzar mordaza	- Alinear - Mordaza centrada - Mordaza centrada	- Medir y etiquetar producto
PUNTO DE ATENCIÓN	- Diámetro de manguera - Color de matriz - Habilidad de anillo a la	- Lubricación periódica del tubo - Tubo libre de impurezas	- Mordaza bien ubicada	- Anillo centrado en matriz - Chequear presión a la de anillo	- Tipo de terminal en la mordaza	- Chequear calidad mordaza - Chequear presión a la de anillo	- Ejes "x" e "y"
ESPECIFICACIÓN	- Según habilita Portmap 2	- Según programa de mantenimiento. Una vez por semana limpiar	- Mordaza correcta	- Según habilita	- Según manual	- Según manual	- Especificar Portmap 2
METODO DE INSPECCIÓN	- Visual	- Visual	- Visual	- Visual	- Visual	- Visual	- Medición
ANOTACIÓN	- Planilla de trabajo	- Programa de mantenimiento				- Planilla de trabajo - Registrar por día o semana la forma de trabajo	- Planilla de trabajo
HERRAMIENTA INSPECCIÓN	- Código de color	- Pincel para grasa - Sople para limpieza	- Código de colores y series - Mordaza tubo correcto	- Código según habilita		- Manómetro	- Calibre
HISTORIAL DE DEFECTO							

Inspection Tool      Inspection Method

*Due to the contract limit, I can't show the actual data. Then, I show an example of my teaching. This is an example of existing products QCPD. The easiest way to choose PFMEA candidates is to use QCPD. I will write QCPD after the day.*

After QCPD, we will develop the implementation of the PFMEA.

Basically (maybe), PFMEA is used for existing product production processes. However, in this case, this project was challenging for completely new products.

After making the QCPD (QC Process Diagram), they voted by cards on the quality concern process.

Vote a quality assurance concern process by cards? ...PFMEA (also FMEA) is a tool of analysis.

Analyses failure modes impacting product quality, process reliability, customer satisfaction, and safety. It considers factors like the 4ME&S (human factors, methods, materials, machines, environmental and safety conditions).

But PFMEA is not only an analysis tool but also a tool for deciding priorities. If there are many processes, it is not realistic to analyze all of them. Also, it is time-consuming. Therefore, it is necessary to decide on the candidate's processes.

This act (selecting and deciding the candidate's processes) should be done for all processes. Therefore, it must be more straightforward and easier but effective. Deciding

on the candidate process is just the entrance. The main act is analyzing candidate processes.

How do you develop such a process? ...My suggestion is that the project members vote. It uses a five-step evaluation.

(II) Standard Evaluation Table						
Frequency		Gravity				
		1	2	3	4	5
	1	1	2	3	4	5
	2	2	4	6	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25
1 <sup>st</sup> Category		1 inspection point				
2 <sup>nd</sup> Category		2 inspection points				

**Severity:** This is the degree of damage when it occurs.

Level 1: The influence is very small even if it were to occur.  
 Level 3: The influence is small, but a countermeasure is required.  
 Level 5: The influence is very serious as it compromises quality and safety.

**Frequency:** This is the degree of possibility of it occurring.

Level 1: The possibility of this happening is very small. Occurrence less than 1 every 3 months.  
 Level 3: Occurrence more than 1 every 3 months.  
 Level 5: It always happens. More than once a week.

## Evaluation

Usually, the PFMEA and FMEA evaluations use three categories, as shown below.

Gravity (Criticality), Frequency, Difficulty of detection.

However, I use just 2 (G and F) because the Implement FMEA simply and more easily.

Even though it is difficult to detect, it is necessary and required to take action, if high score (= G x F).

**5 steps** evaluation? ...Just 2 dimensions (Frequency and Gravity; Severity)?

For instance, a textbook teaches 10 steps and 3 dimensions as following

Weight	Influence	Frequency (of occurrence)
- 10	Fatal	High frequency (more than 1/week)
- 8	Loss of function	High frequency (more than 1/month)
- 6	Function decline	Medium frequency (more than 1/year)
- 4	Minor impact	Low frequency (more than 1/5 years)
- 2	Negligible impact	Very low frequency (less than 1/5 years)
- 1	No influence	No occurrence

### Weight Detection (Difficulty)

- 5 No possibility
- 4 Detection during use

- 3      *Detection in sipping inspection.*
- 2      *Detection in-process inspection*
- 1      *Possible to detect in the work*

As mentioned above, this textbook teaches 3 dimensions, which are: Influence (Gravity), Frequency, and (Difficulty of) Detection.

Influence (my index; Gravity) and Frequency are the same in my table. This book and other textbooks teach three dimensions. However, my method uses two categories for evaluation.

Let's look at each 3 dimensions (by this book. The following is copy and paste)

### **Influence (Gravity)**

*Consider the impact on the product or service when a failure mode phenomenon occurs, as well as the details of the defect. Logically clarify what the impact will be.*

*Rate the magnitude of the impact on a scale of 10. A score of 10 is the most significant and most fatal impact. It can be considered a life-threatening problem.*

*A score of 8 indicates an impact that causes the product or service to lose its basic functionality. It is a state in which the product or service is no longer of any value.*

*Anything that falls between 10 and 8 should be scored 9.*

*The rating criteria will vary depending on the company's reliability policy, customer expectations, the characteristics of the product or service, etc.*

*Make sure to set rating criteria that suit your company.*

### **Frequency (of occurrence)**

*The Frequency (occurrence) rate is rated on a scale of 10.*

*A score of 10 indicates the highest frequency of occurrence. It is likely to occur more than once a week and is considered a daily occurrence.*

*A score of 8 indicates a high occurrence frequency, occurring more than once a month.*

*Anything that is considered to be between 10 and 8 should be rated as a 9.*

*Please see the list of ratings below.*

*Similarly, the rating criteria should be tailored to suit your company.*

### **Detection**



*Next, clarify what kind of management is in place for the defect under your current process management.*

*Clarify the existence and extent of management to prevent the occurrence of the defect or the leakage of the defect.*

*Evaluate the detection rate of the defect under your current process management on a 5-point scale.*

*This represents the degree of likelihood that the defect can be detected with your current management.*

*A score of 5 is the least detectable. It cannot be detected at all. A defect only becomes apparent once it has had an adverse effect on your product or service.*

*Defects related to deterioration or safety margins are often not noticed at all until an accident occurs.*

*Similarly, choose evaluation criteria that are appropriate for your company.*

### **RPN (Risk Priority Number)**

*The impact, occurrence, and detection rates are then multiplied together to calculate the RPN (Risk Priority Number).*

*The RPN is an assessment score for the improvement priority for the risk of a defect. A score of 100 or above indicates that improvement is necessary, and the higher the score, the higher the improvement priority.*

*The method of calculating the RPN, the improvement judgment criteria, and the priority criteria can be adapted to your company.*

When I considered my method, I decided to omit the No. 3rd dimension (Detection). The reasons are 3: One is simpler. Another one is that it is not necessary to use. And the Final one is the serious problem.

Serious problem by using No. 3rd dimension (Detection)? ...First, I explain this serious problem: In conclusion, there is an occasion of omitting necessary items by this 3rd evaluation item.

I explain with one example: Yesterday (2024. 08.23), big news was announced. The outline of this news is as follows: "On the 22nd, TEPCO began preparations for removing melted nuclear fuel (debris) from the Fukushima Daiichi Nuclear Power Plant Unit 2, but halted work after about an hour and a half."

*TEPCO: Tokyo Electric Power Company Holdings, Inc., is the largest electric utility in Japan.*

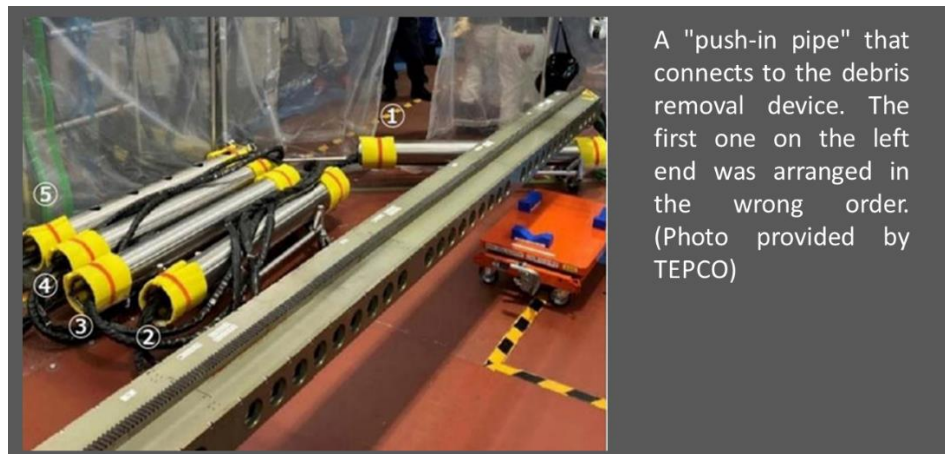
*The order of the pipes into which the recovery device was pushed in was incorrect. It has not been decided when work will resume. The most difficult part of decommissioning the plant, the first debris collection since the March 2011 accident, stumbled just before the starting line.*

...

*Fukushima Prefecture has asked TEPCO to prevent a recurrence, saying that it was a "human and elementary error that could cause anxiety to the prefecture's residents." According to TEPCO, the order was incorrect when the cables were threaded through the pipes at the end of July, and it was overlooked during subsequent inspections.*

*The plan was to insert a fishing rod-style device into the reactor containment vessel to collect debris. When it came time to collect the debris, it was discovered that the order in which the five pipes into which the device was inserted was incorrect. The pipes were numbered to indicate the order, but no one noticed the mistake until the day of the operation.*

*The original plan was to insert a telescopic pipe-type device extending up to 22 meters into the penetration of the reactor containment vessel and use a claw-shaped tool attached to the tip to grab debris weighing less than 3 grams and experimentally remove it.*



A "push-in pipe" that connects to the debris removal device. The first one on the left end was arranged in the wrong order. (Photo provided by TEPCO)

*The five pipes that push the debris collection device into place. They were supposed to be connected in the order of ①②③④⑤, but the on-site worker mistakenly thought they were connected in the order of ②③④①⑤.*

**by TEPCO**

Now, this tremendously big problem is caused by a very simple error. The cause is "human error," and no detection or inspection is in process.

Ridiculous? Can we say it is ridiculous? ... The company that made this device is not small but a large and famous company worldwide. So, I believe he probably implemented a PFMEA for this fishing rod-style arm robot.

From here, this is just my assumption... He probably made the process FMEA and evaluated it using the 3-dimensional evaluation table. But "Incorrect order" occurred and couldn't be found.

Here, the matter is not "made incorrect order" but a system of finding errors. A human makes mistakes, but it is necessary to detect them.



Again, he probably did PFMEA by 3-dimensional evaluation. This human error process wasn't selected as a candidate for PFMEA, even though this process is by hand. Why it wasn't chosen as a candidate for PFMEA?... The cause is this 3-dimensional evaluation table. It is No.3rd Detection (difficulty).

Next is the comparison of the 3-dimensional and my 2-dimensional table.

Influence		Frequency		Detection (Difficulty)		RPN
		(of occurrence)		Possible to detect in the work		
Fatal	8	Medium	6	Very easy to detect	1	48/500
Function decline	5	Low frequency	4			20/25

The upper column is 3-dimensional with Detection. The lower column is 2-dimensional (by 1,3,5 evaluation). The items of Influence and Frequency were evaluated at almost the same level, but the item of Detection was evaluated as 1.

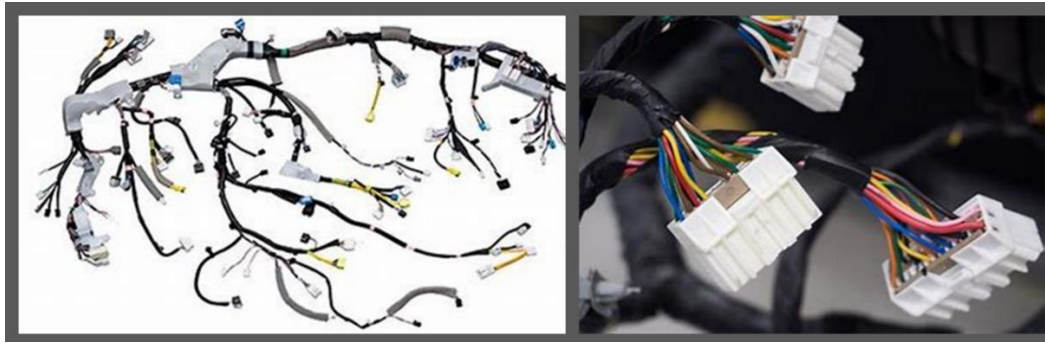
(II) Standard Evaluation Table							Detection (Difficulty)	
		Gravity					5	No possible
			1	2	3	4	4	Detection during use
							3	Detection in shipping inspection
							2	Detection in process inspection
							1	Possible to detect in the work
Frequency	1	1	2	3	4	5		
	2	2	4	6	8	10		
	3	3	6	9	12	15		
	4	4	8	12	16	20		
	5	5	10	15	20	25		
		1 <sup>st</sup> Category	2 inspection point					
		2 <sup>nd</sup> Category	1 inspection point					

The complete count RPN of 3 Dimensional is  $10 \times 10 \times 5 = 500$ . And the evaluation was 48/500. It was a very low evaluation result.

On the other hand, the 2-dimensional table shows that the complete count RPN is  $5 \times 5 = 25$ . The evaluation is 20/25 and categorized as very high risk.

I show another example, which is my experience.

The following photos include a vehicle wiring harness and the bleach-end connectors. The connectors have cavities and electric wire inserted. The problem is that the inserted cable misses the location (point in cavities).



As you know, each branch has connectors that are connected to the vehicle's equipment. The problem is terminal insertion into the connector, which has been mostly done by hand so far.

Now PFMEA: Failure mode (Potential Problem); Miss Location. Inserting a terminal into the wrong cavity.

Evaluation analysis: Let's compare 3-dimensional and 2-dimensional.

Influence		Frequency		Detection (Difficulty)		RPN
		(of occurrence)		Possible to detect in the work		
Fatal	8	Medium	6	Very easy to detect	1	48/500
Function decline	5	Low frequency	4			20/25

I can use the almost identical example of the case of TEPCO.

(II) Standard Evaluation Table						
		Gravity				
		1	2	3	4	5
Frequency	1	1	2	3	4	5
	2	2	4	6	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25
1 <sup>st</sup> Category		2 inspection point				
2 <sup>nd</sup> Category		1 inspection point				

Of course, it is necessary to take something countermeasures by the evaluation of 2-dimensional table.

How did we do? ...Double check (inspection): Wasn't notable effects. Still, quality claims by customers occurred. Even though it is done, the final electric check inspection is.



Above is the Image of the wiring harness's final electric inspection device and the subassembly process electric inspection device on the right-hand side.

An additional countermeasure was the electric check inspection in the subassembly process, where the main work was the terminal insertion in connector cavities.

Terminal insertion in the cavity. And defect of missing location.

Double-check the visual inspection. However, the defects were found in the customer's production line. (Even though the final electric inspection is done.)

Then, a subassembly (terminal insertion process) electric inspection is introduced.

Now, once again:

Influence		Frequency		Detection (Difficulty)		RPN
		(of occurrence)		Possible to detect in the work		
Fatal	8	Medium	6	Very easy to detect	1	48/500
Function decline	5	Low frequency	4			20/25

Why is there so low evaluation in 3-dimensional evaluation (48/500) compared to 2-dimensional table (20/25)?

It is pretty clear and is the existence of (Difficulty of) Detection and is the interpretation.

Detection (Difficulty)	
5	No possible
4	Detection during use
3	Detection in shipping inspection
2	Detection in process inspection
1	Possible to detect in the work

"This represents the degree of likelihood that the defect can be detected with your current management."

We shall make misunderstanding this sentence: Inspection of "terminal insertion in correct cavity". Is this difficult? ...No, not at all. The worker can concentrate on the job. Is this difficult to find in double inspection? No, not at all, because of the upper reason.

However, it isn't easy. Therefore, there is a word for human error.



### **Definition of Human error**

*Human error refers to actions or decisions made by individuals that deviate from what was intended, expected, or desired, leading to unintended consequences. It can occur in various forms, such as:*

**Slips and Lapses:** *Unintended actions, like forgetting a step in a process.*

**Mistakes:** *Actions that go as planned but are based on incorrect assumptions or knowledge.*

**Errors of Execution:** *When the plan is correct, but the execution fails.*

*Human error is a significant factor in many accidents and failures across different industries, including aviation, healthcare, and manufacturing<sup>1</sup>. Understanding and mitigating human error is crucial for improving safety and reliability in complex systems.*

**By Wikipedia**

There is another rule: It is requested to take countermeasures, even though the Detection (of Difficulty) is low if Influence and Frequency are high rates by the 2-dimensional table.

Terminal insertion in the correct cavity. It is a straightforward process. However, my 2-dimensional evaluation table requests certain countermeasures.

So, I don't recommend using 3-dimensional because of following 3 following reasons:

- There is no reasonable reason to eliminate items which are processed by human feel (attention, feel) if the process is ranked high Influence and Frequency.
- (Relating to upper column) Recognizing that a human is an animal that makes mistakes is necessary.
- (Cutting corner) We need to evaluate more straightforwardly. (My evaluation table is simple, isn't it?).



### **What is FMEA?**

*(This is a copy-paste from SNS. If you don't like to read, you can ignore this.)*

*Failure Mode and Effects Analysis (FMEA) is a systematic approach used to identify potential failures in a design, manufacturing process, or product/service. Failure Modes: These are the ways something might fail—such as defects, errors, or malfunctions.*

*Here's how it works:*

***Effects Analysis:** It involves studying the consequences of those failures. How serious are the effects? How often do they occur? How easily can they be detected? ...Effect Analysis (From "Learn Lean 6-Sigma")*

***Prioritization:** FMEA prioritizes failures based on severity, occurrence, and detectability. The highest-priority failures are addressed first.*

*The goal of FMEA is to take action to eliminate or reduce failures. It's used during design and throughout the product or process.*

***Evaluate Severity, Occurrence, and Detection:** The aim here is to quantify the risk associated with each failure mode. These three criteria help understand the magnitude of the problem and prioritize corrective actions.*

*How to Implement:*

- **Severity (S):** Rate the seriousness of the consequences if the failure occurs. Typically rated on a scale of 1 (least severe) to 10 (most severe).
- **Occurrence (O):** Assess the likelihood of the failure mode occurring. Again, this is usually on a scale of 1 (least likely) to 10 (most likely).
- **Detection (D):** Evaluate the likelihood that the current controls will detect the failure mode before it reaches the end customer. This is rated on a scale where 1 means it's very likely to be detected and 10 means it's improbable.

*Almost, no, utterly the same as the above example 3-dimensional evaluation table. Therefore, so far, the common understanding of the FMEA evaluation table in the world is as shown in the text above.*

Now, **Failure Modes:** It is possible to replace and use "Potential Problems." The first step is to list the Potential Problems in the products or the production processes.

The 3-dimensional evaluation table does the effects analysis. And Prioritization, the same as above.

Is FMEA familiar to use in medium-class companies worldwide? ...The answer is no, it is not popular in medium- or lower-class companies (I don't know the situation of large companies, but maybe do it).

FMEA is a well-known knowledge but not popular worldwide. Based on my experience, however, I don't know the current situation in 2024<sup>5</sup>.

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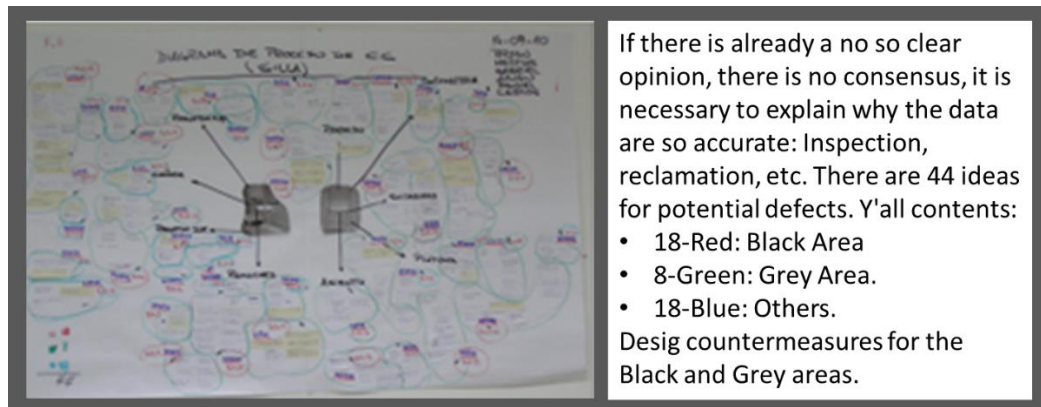
<sup>5</sup> **FMEA 4<sup>th</sup> edition:** New version released in 2019 by AIAG & VDA FMEA: Now Accepted by GM, Ford, Stellantis, Honda NA, BMW, Volkswagen Group, Daimler/Mercedes, and Daimler Truck. "Created by the Automotive Industry Action Group (AIAG) and the German Association of the Automotive Industry (VDA), the Handbook was supposed to harmonize the existing AIAG and VDA FMEA manuals to create a standard for the use of FMEAs throughout the world automotive industry"

<https://www.youtube.com/watch?v=yS3eThOX6kE>

<https://es.scribd.com/document/601842124/FMEA-Handbook-1st-Edition-2019-EN-VDA>

When I interviewed them, their answers were as follows: Most said that we understand the necessity, but it doesn't seem very easy. Others responded: Troublesome. Finally, most of them expressed that they do not know such a method.

I'm talking about some Interviews, am I not? ...Yes, I do it when training the PPM method—Potential Problem Map. Then, I recommend that they use PPM better than FMEA.



I will describe deeply the PPM in a later issue.

After all, the function of FMEA is following two points:

- 1 One is the consideration of Potential Problems.  
This requires the capacity for creative thinking, whether the objective is well-experienced or not. I have seen some examples of failure (not effective FMEA activity).  
Failure examples? ...These included my failure cases in my previous company. The leading cause of failure is the poor consideration of potential problems by creative thinking. When we made the FMEA activity, we did it with just QA staff.
- 2 And, the other is the standard of the evaluation.

However, here, let's continue with the description of FMEA and look at its form.

Next is just one example. I instead omit the explanation of each item:

PFMEA Example												
#	Process & Work	Failure mode	failure cause and mechanism	Freq.	Possible causes	Grav.	Evaluation			Countermeasures		
							Frequency	Gravity	∏	Design		Process
1	Assembling the switch into the main body	Electrode deformation when assembling	When assembling the electrode part touches the case and it is deformed. The electrode part does not come into contact	3	When installing the case the electrodes cannot be seen, so assembly is made by feel	5	3	5	15		Jig & Tool development	PE
			The switch set was installed backwards. The electrodes were in contact the case causing deformation. The electrodes were not in contact.	2	Prevention of reverse assembly depends on the operators <b>attention</b>	5	2	5	10	Poka-Yoke by color in case	DE	
			When removing the switch set from the parts box, the electrodes may be hit against the parts box, causing them to deformation and preventing the electrodes from contacting each other.	3	Removal of the switch set relies on the operators <b>attention</b>	3	3	3	9		Standardization and indication of electrode storage	P/E

And the following is another example I used:

### FMEA Product Diagram

						Product Name:		
						Product Number:		
						Date & Version:		
#	Potential Problem	Part/s	Evaluation			Countermeasures		
			Frequency	Gravity	□	Design	Process	

Backing to this Arrow Diagram team, as I wrote before, this company needed to recover from the delay in the new plant construction schedule and the increase in its investment fund.

Additionally, as my task, I requested the support of a new product introduction. The Initial products quality control (IPQC) team was established as a support team. The PFMEA challenged one of their IPQC activities.

Firstly, I suggested the PPM activity. However, the QA manager strongly requested that PFMEA be implemented. I had no choice and taught them to make it up.



#### The steps of PFMEA are as follows.

- 1 Selection of candidate's production processes in large flow in Arrow diagram (by discussion and voting).  
For instance, the 500Tm press production process was chosen because of the new experience, a new assembly line (switch case assembly), etc.
- 2 Make a QC Process Diagram about the quality concern process.  
Normally, this process can be omitted. I dare to suggest that they do so. Therefore, you can ignore this process if you can imagine the concern process sufficiently.
- 3 The candidate's production process (Quality concern process) is selected in the production process by voting with an evaluation table.
- 4 FMEA Diagram making.

Listing up the quality concern in the FMEA Diagram and making up the FMEA in line with the diagram.

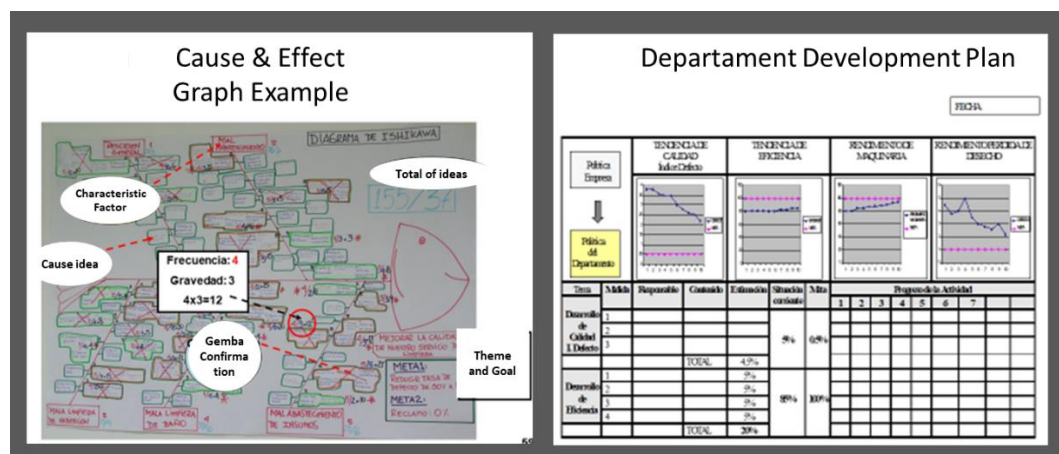


Well, it looks pretty tedious when written down. Anyway, this technique (I think it is not a technique, but just poor 5Whys) is just 2 activities (factors) as above.

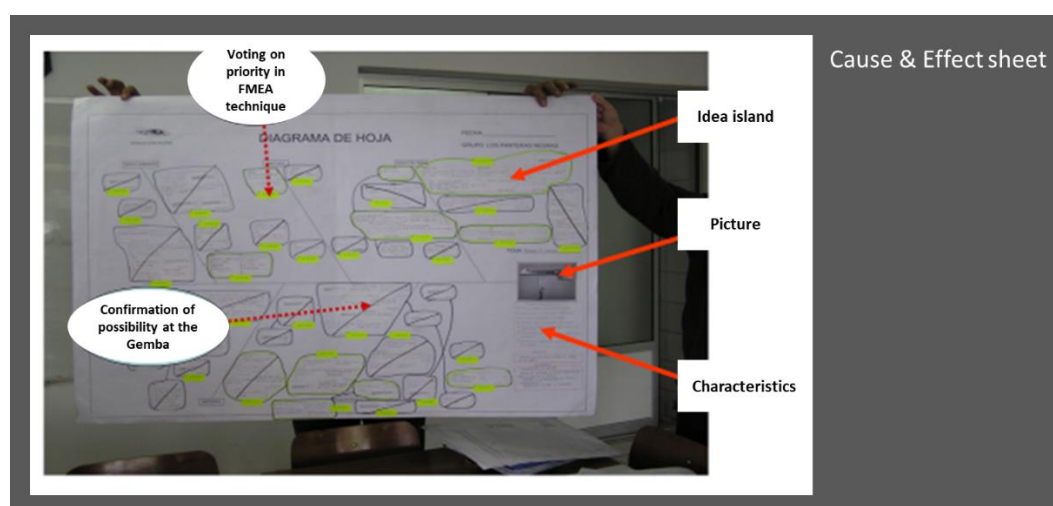
Again, there are two factors: the consideration of Potential Problems and the evaluation standard.

Evaluation to narrow down the concern processes reasonably is an essential factor for the activity of FMEA.

By the way, I'm doing an FMEA at any time. You may wonder if I say that always or at any time, I'm doing an FMEA. Please look at the following example of a Fishbone Diagram: As you find, this group was doing a potential quality concern analysis using a fishbone diagram. They evaluated these ideas using the 2-dimensional evaluation method. After this analysis, they created an action plan in the form below. This is the case of a new product.



Let's look at another fishbone diagram below. The Gemba QC Circle group made this and was the case with a current product.

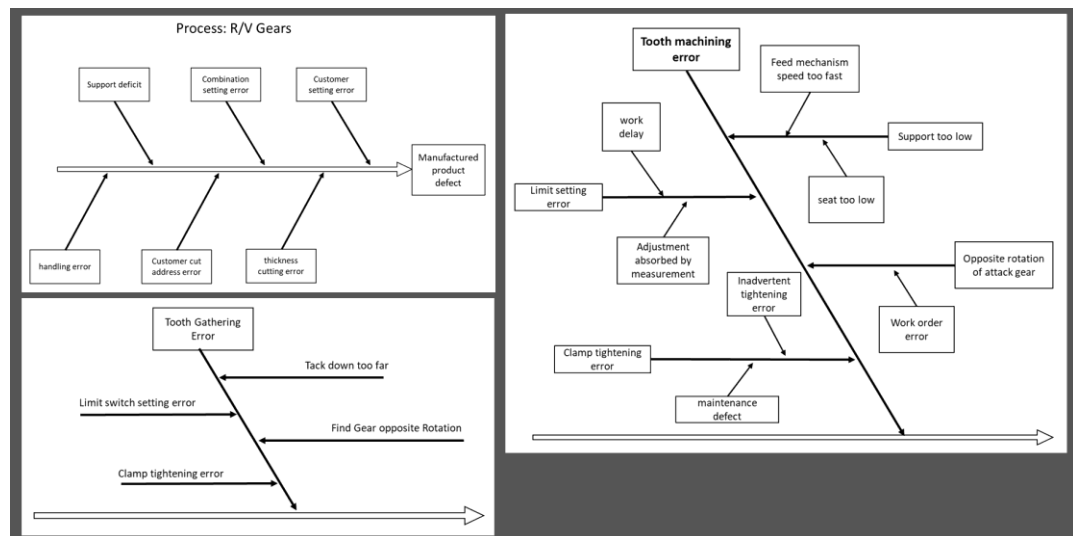


This operators' group also uses the FMEA technique in the fishbone diagram easily.

A fishbone diagram is one of the 5Whys analysis tools as below.



Let's compare the Fish bone diagram activity and FMEA.



Defect: Tooth gathering error

- 1<sup>st</sup> cause: Clamp tightening error, and other 5.
- 2<sup>nd</sup> cause: Limit switch setting error, and other 3.
- 3<sup>rd</sup> cause: Support is too low, and the opposite rotation of attack gear is needed.

This example shows 3 Whys against the defect problem of “Defect on the manufactured part.”

I haven't completed the 5Whys in the Fishbone activity. I'm sorry. I will write the KJ Fishbone diagram in a later issue.

Comparing these examples and the Arrow diagram team PFMEA.

PFMEA Example												
#	Process & Work	Failure mode	failure cause and mechanism	Freq.	Possible causes	Grav.	Evaluation			Countermeasures		
							Frequency	Gravity	∏	Design	Process	
1	Assembling the switch into the main body	Electrode deformation when assembling	When assembling the electrode part touches the case and it is deformed. The electrode part does not come into contact	3	When installing the case the electrodes cannot be seen, so assembly is made by feel	5	3	5	15		Jig & Tool development	PE
			The switch set was installed backwards. The electrodes were in contact the case causing deformation. The electrodes were not in contact.	2	Prevention of reverse assembly depends on the operators attention	5	2	5	10	Poka-Yoke by color in case	DE	
			When removing the switch set from the parts box, the electrodes may be hit against the parts box, causing them to deformation and preventing the electrodes from contacting each other.	3	Removal of the switch set relies on the operators attention	3	3	3	9		Standardization and indication of electrode storage	P/E

1. Process: Assembling the switch set into the main body case
2. Assumed problem: Electrode deformation when assembled
3. Fail Cause and Mechanism (First Why): 3 ideas.
  1. When assembled, the electrode part touches the case and is deformed. It does not come into contact.

4. The switch set was installed backwards. The electrodes were in contact with the case, causing deformation, but they were not in contact.
5. When removing the SWITCH set from the parts box, the electrodes may be hit against the corners of the parts box, causing them to deform and prevent the electrodes from contacting each other.



### 5-Whys 'vs' 1-Why?

*As you understand, FMEA has just 1 Why analysis. What a poor it is!*

*Once again, FMEA: Failure Mode and Effects Analysis (FMEA) is a methodology for identifying potential failure modes in a product or process, assessing their effects, and taking measures to improve quality and reliability. And the contents are just two below:*

- *One is the consideration of Potential Problems. However, Cause analysis is too poor.*
- *And the other one is the standard of the evaluation.*

6. Action plan: Other items such as cause analysis, countermeasures, and action plans are not necessary to the FMEA process. These can be considered using other methods, such as the 5 Whys and action plans.

So far, so many techniques or methodologies have been devised. Are all these necessary for quality improvement? No, not at all.

How different are the Fishbone and Failure modes of FMEA? ...Fishbone or PPM + 2-dimensional table + Action plan = FMEA function.

And,

Fishbone or PPM + 2-dimensional table + Action plan is much better than the FMEA function.

It is not difficult to implement FMEA. However, you must have your own evaluation method. It is also not necessary to be three-dimensional. I recommend two-dimensional, which is easier.

Do you need the following form? Here it is, even you can make your own own:

**FMEA Product Diagram**

						Product Name:		
						Product Number:		
						Date & Version:		
#	Potential Problem	Part/s	Evaluation			Countermeasures		
			Frequency	Gravity	Π	Design	Process	
						<div style="border: 1px solid black; border-radius: 50%; padding: 5px; text-align: center;">A P C D</div>		<div style="border: 1px solid black; border-radius: 50%; padding: 5px; text-align: center;">A P C D</div>
						<div style="border: 1px solid black; border-radius: 50%; padding: 5px; text-align: center;">A P C D</div>		<div style="border: 1px solid black; border-radius: 50%; padding: 5px; text-align: center;">A P C D</div>
						<div style="border: 1px solid black; border-radius: 50%; padding: 5px; text-align: center;">A P C D</div>		<div style="border: 1px solid black; border-radius: 50%; padding: 5px; text-align: center;">A P C D</div>

Once again, so far, so many techniques or methodologies were devised by wise scholars. Are all these necessary for quality improvement activity? ..No, it is not required all.

For example, Six Sigma is a quality control and management methodology developed by Motorola in the 1980s.



**6-Sigma** (Copy and paste from SNS. It is unnecessary to read if you don't like it.)

*Six Sigma is a data-driven methodology for improving process quality by identifying and eliminating defects and variability. Motorola developed it in the 1980s and later popularized by General Electric under the leadership of Jack Welch<sup>12</sup>.*

*Here are the key aspects of Six Sigma:*

- *Goal: Achieve near-perfect quality, aiming for no more than 3.4 defects per million opportunities.*
- *Methodology: Uses the DMAIC framework (Define, Measure, Analyze, Improve, Control) for improving existing processes and DMADV (Define, Measure, Analyze, Design, Verify) for creating new processes or products.*
- *Tools: Employs various statistical tools and techniques such as control charts, failure mode and effects analysis (FMEA), and root cause analysis.*
- *Roles: Involves different levels of expertise, often referred to as "belts" (e.g., Green Belt, Black Belt, Master Black Belt), similar to martial arts, to lead and implement projects.*
- *Focus: Emphasizes customer satisfaction by reducing process variation and improving process capability<sup>23</sup>.*

*Six Sigma has been widely adopted across various industries, including manufacturing, healthcare, finance, and more, to enhance efficiency and quality.*

**By Wikipedia**

DMAIC cycle? ...DMAIC Cycle: Define, Measure, Analyse, Improve, and Control. This is the same as the QC step by K. Ishikawa.

Simply put, 6-Sigma is one kind of project activity and management with QC (Statistical Quality Control).

There are many methodologies. But they can only be evaluated when used in Gemba. Now, I believe you don't feel the necessity of FMEA. Do you need such a methodology, and can you implement it? ...I will write about it in a later issue if I have time.



**Lean 6-Sigma!?**

*Lean 6-Sigma (Copied and pasted from SNS. It is not necessary to read if you don't like it.)*

*Lean Six Sigma is a methodology combining Lean and Six Sigma principles to improve efficiency and quality in processes. Here's a breakdown of what it entails:*

### Lean Principles

- *Focus: Eliminate waste and improve process flow.*
- *Tools: Value Stream Mapping, 5S (Sort, Set in order, Shine, Standardize, Sustain), Kaizen (continuous improvement).*

### Six Sigma Principles

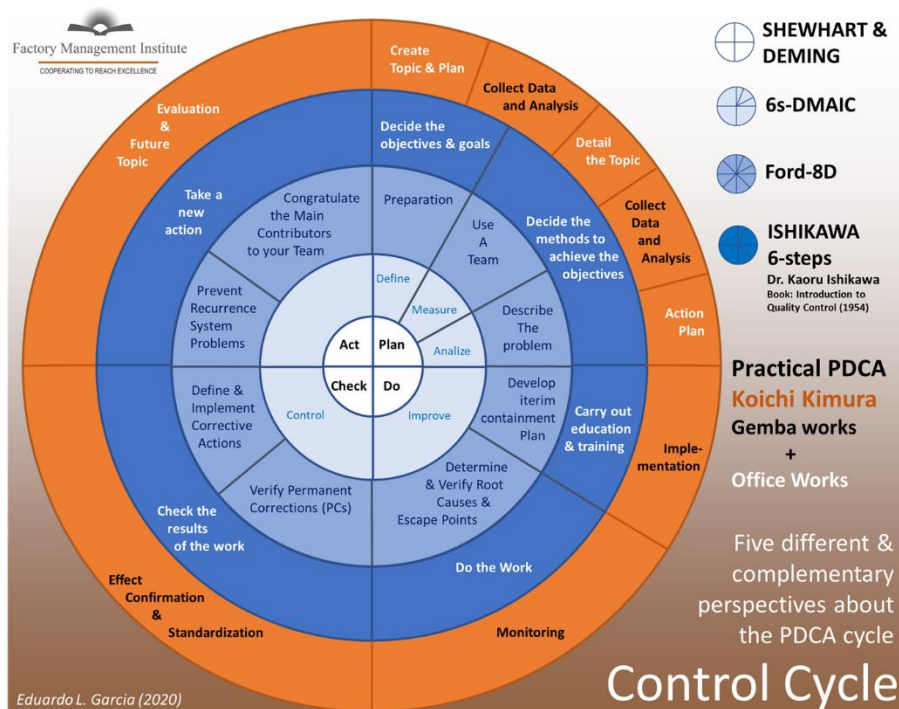
- *Focus: Reduce variability and defects.*
- *Tools: DMAIC (Define, Measure, Analyze, Improve, Control), statistical analysis, control charts.*

### Lean Six Sigma:

- *Integration: Combines Lean's focus on waste reduction with Six Sigma's focus on reducing variability.*
- *Goal: Enhance process efficiency and quality simultaneously.*
- *Methodology: The DMAIC framework is used, and Lean tools are integrated at each stage.*
- *Benefits: Faster processes, higher quality, reduced costs, and improved customer satisfaction.*

*Lean Six Sigma is widely used in various industries, including manufacturing, healthcare, and finance, to streamline operations and deliver better products and services.*

**By Wikipedia**



Again, 6 Sigma? ...Does it have essential and core techniques? Yes, it has, and it is the project management by Black belt, green belt like as Judo or Kendo and Champion (External Consultant)??? ...Are these essential and core techniques in the world?

Lean? ...It is an imitator of TPS (Toyota Production System). What are the characteristics and core techniques? ...I don't deny 6-Sigma, lean. But

I suggest pursuing and mastering the way of essential and basic techniques. I sorry for my friends who are believers in such methodologies.

### III. JISHU-KEN (II)

This is the continuation of Jishu-ken, which I wrote in the previous issue.

This Jishu-Ken group made a special presentation at the management team meeting.

Once again, the members of this Jishu-ken were **Em**: Engineering, **Hr**: Human resources, **Mp**: Production planning, **Pm**: Production, and **Sm**: Sales, a total of five sectional managers. Then, they held irregular meetings 12 times a month. They studied by themselves, did interviews, or invited knowledgeable persons.

Therefore, starting the discussion of the main theme, there was a dialogue. The **Mp** mentioned: —Even so, last Jishu-ken was so shocked for me —and he continued—. In a typical accounting system, manufacturing costs are recorded as assets regardless of whether the manufactured products are sold or not, so profits may appear to increase in monthly base accounting when inventory increases caused of excess production.



*Specifically, manufacturing costs are recorded as assets as inventory, and are recorded as cost of sales only when the products are actually sold. Therefore, even if the manufactured products are not sold, they are recorded as inventory, so it may appear that profits are being made on the income statement.*

—Moreover, the inventories which my plant produces has many defects and are required additional inspection and repair work when shipping (selling). And at this moment in time, it looks like there is a conflict in the management team. I'm sad and sorry.

—Mr. **Mp** —the **Hr** asked him—, you are our team member and friend. Don't be so sad and pessimistic. At this time, our essential aim is to find a solution and implement it. Fortunately, we are in a position to implement solutions as well.

The **Em** intervened: —We could make beneficial suggestions to the management team regarding the treatment of product M...

—Last time we studied why top management are intending to Marginal profit management rather than pursuing sales amount and ordinary profit...

—The conclusion is to pursue "entire optimization". As **MP** reminisced, the more it made, the more profit it made, even if it didn't sell. This fake profitability is corrected at end of term. Even so, we cannot use such data for daily, weekly and monthly base factory management.

—Entire Optimization and TOC —**Em** emphasized.

—Pursuing "Entire optimization" —**Sm** detailed—. When reading this word, it may be very much similar to TOC (Theory of Constraint). TOC is also pursuing it through Throughput management...

—However, according to the lecture of Sensei Kimura, such a management style is not rare, and has existed for a long days ago and has been implemented in some companies.

—Entire Optimization —**Em** insisted—. Pursuing profit. Inventory. Overproduction. Sales and Sales amount. Etc. It is necessary to take balance. And, to seek this good balance, Marginal profit management is suitable. It was our conclusion, wasn't it? ...

—These are target items of Entire Optimization by Marginal Profit Management, right?  
 —without waiting for any answer, **Em** questioned again himself—. So, what are the target items of Entire Optimization by TOC? ...According to the book, the target items include such organizational optimization.

—Therefore, I cannot understand —**Hr** hesitated—. Including organizational optimization? How?  
 —He asked, and then he again asked—. By the Kaizen step of TOC?

—Even so, what was TOC? —**Pm** asked to the group.

**Em** answered: —TOC, Theory of Constraint. I also read the book, which is like a novel. And it was easy to understand. Eliyahu Goldratt's "The Goal" is primarily aimed at maximizing throughput (Output and Value created by the entire system) by identifying and improving bottlenecks in the manufacturing production process.

—And according to a book, the throughput (output) Kaizen step is as follows:

- 1 Identify constraints: Identify the bottlenecks (potential problems) limiting your organization's performance as a whole.
- 2 Exploit constraints: Find ways to make the most of the bottlenecks and increase throughput.
- 3 Depend on other processes: Adjust other processes to fit the bottleneck to optimize overall efficiency.
- 4 Repeat: If new bottlenecks emerge, repeat the process.

—So, once again, TOC is one of the Output Kaizen steps, isn't it? —**Hr** asked.

**Em** answered: —It can be said so. But one of what I don't understand is to seek Entire Optimization by TOC process above. Do we follow such steps?

—Now, one group is learning PPM (Potential Problem Mapping) by Sensei Kimura to identify the potential problems of the entire production, including quality issues and production and safety. It may be a large map.

*Below is just an image of PPM of one product...*





—So, do we follow such TOC story? —**Em** asked to the group.

—When reading this book —**Em** described—, it was a riveting novel. But, if reading this book as a process Kaizen story, it is indeed foolish. But everyone, put that aside, the theory of Throughput management should be considerable. Because it is similar to our Marginal Profit management concept (which is to pursue “Entire Optimization”) ...

—I'm just repeating what I read in the book, and this book said that Throughput management aims for "Entire optimization or all departments' efficiency" to maximize the entire organization's performance.

—I see —**Sm** admitted—, is that so? TOC. Hmm, I wonder what this is...

—Pursuing Entire Optimization —**Sm** detailed—. First, Our Entire Optimization by Marginal profit management and TOC seems different.

—But I have heard some companies succeeded in improving the performance by TOC —**Pm** explained—

And then the **Sm** asked the group: —So, how about now?

—I don't know —**Pm** admitted.

The **Hr** tried to untie the situation: —Listen, everyone. The essential thing about an improvement activity is "continuity." We have bitter memories about the companywide improvement. It is the TPM (Total Productive Management) led by a consultant. Initially, our company was cheered up. But soon, it was toned down. Only 6 months. Then we had the deadlock. I think any activity can give some "booster effect." TOC can also be given the booster effect if implemented by any company. Unfortunately, however, there is no continuity. Therefore, Sensei Kimura is teaching "Kata." He said it is a bit long-term and requires effort to stabilize Kata.

—Oh yeah —**Pm** agreed—, that's right! And we were not good students. No, no, no. Not we, but me.

—Anyway, TOC is not understandable so far —**Pm** sadly admitted—. Shall we not study TOC more?

**Em** hesitated: —Hmm... I think we don't need more. Everyone. Do you remember the dialogue with Sensei? ...Sensei told us there are many methods for continuous improvement (Kaizen). Then he told us 3 things: One is that learning various methods is a good thing. Another is, “However, it is sufficient with few essential techniques. And finally, it is an important point: It is unnecessary to have many techniques. He also said we should be experts in these few and limited techniques.

—Yes —**Mp** agreed—. We remember his teaching, and he also told us next. Innovation, improvement. The target items are 3: Future potential problem, Present potential problem and Problem in front...

—Making such problems apparent (excluding the problem in front). Making expected causes for these. And, Making ideas of countermeasures...

—And it is to use these limited techniques fully —**Mp** concluded.

Then the **Hr** intervened: —We remember the teachings. So, what are essential limited techniques for us? We need to select these and learn more. Even so, I think TOC cannot be the candidate. —the rest of the teams seemed to approve of that point of view just because no one made a replica—. So, Let's leave the topic of TOC at this point: PPM

—By the way —**Hr** continued—, PPM activity. Some people from our departments are attending to this. Sensei Kimura told me this activity is a play (game). Based on this map with priority, identifying the themes of QC Circle (Gemba kaizen) and improvement tasks of departments. And, of course, these themes are put into the action plan.

—Let's stop the conversation about TOC and move to the central theme —**Em** mentioned.

—Please wait, everyone —asked **Pm**—. Before going to the central theme, why not discuss the matter of present concern? Because our study and presentation induced this.

The **Hr** took the ball: —Got it. It is the cost recovery plan for our company's main product, series M.

—Yes, it is —**Pm** agreed—. After all, it's our flagship product. Fortunately (unfortunately), our suggestion was applied. Again, their suggestion was as follows: “The sales price of product M (The company's main product) 100usd was accepted. Even so, the 100usd (MpR) Marginal profit rate is 10%. 10% it is!

Numeric value-2-P/L		
Item	Fomula	Value
Sales volume	G	500
Sales amount	$H=G \times A$	50,000
Fixed cost	$I=D$	20,000
Variable cost	$J=G \times B$	45,000
Variable cost + Fixed cost	$K=I+J$	65,000
Marginal profit	$L=H-J$	5,000
Profit & Loss	$P/L=H-K$	-15,000

—As expected, and even so it was possible to earn the Marginal Profit, the ordinary profit was worsened...

—Even so, it is a tremendous deficit in just one product series. I wish to contribute to resolving this situation because of my standing position. Could you please help to make up the action plan? —**Pm** asked without waiting for an answer. At present, these flagship products have a triple whammy. One is the excess inventory. Another one is required the additional costs of re-inspection and rework. And the last one is the lost competitiveness of sales price.

—Yeah —**Mp** admitted—. You are right. There was a discussion of disposing of these excess inventory M as well. But AD disagreed with this idea because of the big disposal loss and the effect on the ordinal profit at the end of the term...

—Yes, there is no way to dispose of excess inventory despite a large deficit. Therefore, there is no way to sell these without even lowering the price.



Then Em questioned: —What can we do now to make suggestions about the future —He tried to come up with some conclusions: —One is to avoid secondary damage, which is a customer's quality concern. And the second one is to minimize the additional cost.

—What is your concrete idea, **Em**? —**Hr** questioned **Em**.

Then **Em** tried to describe his ideas more deeply: —This idea may solve both quality and cost (workability) issues. My idea is to make the line. Sensei Kimura told us to create a stream of the working process as much as possible.

—Unfortunately, M inventories require the re-inspection and rework of all products. Therefore, shall we suggest making a line stream?

—Re-inspection and repair line. Very pity, but... —**Pm** admitted—. I do, everyone. This idea can be achieved through my own decisions and responsibility.

—No need to speak to Mr. **Pd** (Production director), do you? —**Mp** asked him.

—No, I can do it with **Qa** manager.

Then **Hr** questioned: —Hmm... Making stream of production. Maybe it is a good idea. I also have ideas for the future. My suggestion is to prepare the training system with "skill evaluation." This idea also was suggested in the Gemba Committee meeting. I would implement it by my responsibility.

—These are good ideas and are possible for us to implement. —**Em** agreed—. However, let's present in the following management team meeting.

But **Sm** asked everyone: —How can we suggest the Cost recovery relating to the sales price down?

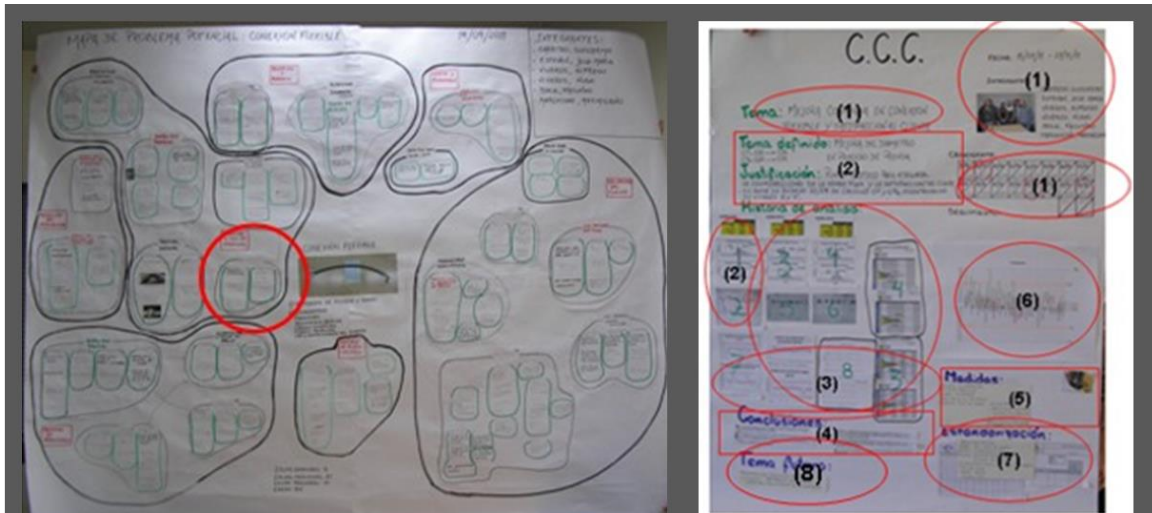
**Em** answered him with a new question: —Shall we invite **Af**-san (Accounting staff) to listen to his idea?

—As you know, one team is doing a PPM activity. And, the objective production line is the M series. Ha, ha, ha! —**Em** laughed—. Mr. **Af** is the team leader of this PPM activity. And he is the husband of a former famous team leader, as you know. His team is enjoying PPM activity by KJ.

—I wish to collaborate with them to make up the action plan —**Em** concluded.

**Sm** was very interested in this development. We know his group is making the PPM - Potential Problem Map chart for Plant-2 (factory of M series). Indeed, it is fascinating. I like the idea of **Em**. Let's collaborate with this group. This group involves Accounting, QA, Gemba team leader and other 2 department persons. Also, our **Jishu-ken** team comprises heads of human resources, production, engineering, production planning, and sales.

—According to information, this PMM group has two purposes —**Mp** detailed—. One is to identify the potential problems of this plant. Another is to select the theme of QC circle by priority.



We choose the next topic on the map prioritizing quality and according to the importance of the problem and its impact on production. After 4 months of activity of the quality control circle (QCC), the presentation was made to the Kaizen Committee. At that time, the next point of improvement of the group is also presented: Next topic.

—Probably, they wish to challenge to resolve by a **Genba QC circle** activity and approaching from **Genba**.

—Good —**Em** agreed—. We appreciate their approach. And, as you know the word of Kimura-san, when intending factory improvement such as our plant-2 improvement, it is necessary to consider the 3-dimensional approach. These are from **Genba (Genba-Kaizen)**, Organization and KPIs.

—I guess Mr. **Af** and his team will turn into an action plan —**Em** rectified suddenly—. No, it is probably impossible to turn into a specific action plan by just them. The problem which **Genba-Kaizen** can improve. The problem that requires the involvement of the organization.

—Turning into an actionable plan is the task of managers —**Em** detailed—. Prioritizing for QC Circle is their task.

...

## KPIs Based Management

—By the way of the KPIs —**Pm** broke the conversation—. Recently, one of activity was discussed by the top management team. It is KPIs.

—Ahn! again? —**Hr** disagreed—When Sensei Kimura joined the first time, his lead was 3 dimensional, as above. One is Gemba, an organization, and the other is KPI-driven management. Then, we established the necessary KPIs as one of Kata's management. But again?

—Yes —**Em** dive into the explanation of **Hr**—, once again. And we will be informed soon. According to Mr. **AD**, our company has moved to the second stage of KPIs control, which is called "KPIs Based Management," named by Mr.**AD**.

—Oh, don't worry so much —Em distressed—. We prepared essential data for each department. Therefore, we do not have much additional data to establish. For instance, the department of **Sm**-san has an Order Forecast database based on past data and market and customer conditions. **Hr**-san also has your essential database, don't you? —Em asked **Hr**.

—Engineering... Hmmm. Still, it is poor. But I have the KPIs of quality and a person's performance. Anyway, we do not have so many tasks for additional KPIs we have.

—So —**Sm** concluded with a question—: Why is the second KPIs-based management activity starting?

**Em** answered: —Again, according to the talk of Mr. **AD**, the contents of this improvement are 3 items:

- One is to supplement necessary KPI items by all departments.
- Another key activity is improving the quality and speed of data for quick response control and management.
- The last one is to understand, once again, the meaning of each number of KPI by everybody, including people in the **Genba**. One of the key activities is visualization of them in the **Genba**. The companywide KPI study session will be planned for soon.

—Of course, expertise is necessary to understand the meaning and use of numbers. **Genba**, office, etc. Anyway, not just gathering data but understanding and using it are essential.

- Another is to use these for analysis and forecasting. For instance, edge computing will be expanded more. Not only the **Production-Genba** but also, for example, **Sm**-san, you may be and will be requested to bring an edge computer for a visiting customer.



### Edge AI

*(If you have the information, it is unnecessary to read. It's just repeating what I've read.)*

*I have written regarding edge computing in production Gemba In somewhere. And at present, next boom is coming (2024. Sep.). It is so called "Edge AI".*

*According to the SNS information, the explanation of Edge AI is next.*

*Edge AI is a technology that runs AI (artificial intelligence) on terminals or devices called "edge" that are close to users, rather than on cloud servers. Edge refers to devices with limited computing resources, such as smartphones, sensors, cameras, automobiles, robots, and IoT devices.*

### Features

Low latency: *Instead of sending data to the cloud for processing, data is processed directly on the device, improving response times and enabling real-time processing.*

Security and privacy: *Data is processed on the device instead of to the cloud, providing better protection for personal data and reducing security risks.*

*Bandwidth savings: No need to send large amounts of data to the cloud, reducing network bandwidth usage.*

*Offline operation: Edge devices can run AI models even without an internet connection, allowing operation in places with poor infrastructure.*

### **Examples of Edge AI Uses**

*Autonomous driving: Edge AI is used to enable cars to understand the surrounding situation in real time and make instantaneous decisions.*

*Smart home appliances: Edge AI is used in home appliances to recognize user actions and the environment and automatically optimize.*

*Industrial robots: Robots use edge AI to perform tasks in factories and other places to automate and improve efficiency.*

*Edge AI is a technology that is expected to continue to develop in the future, and it will be the key to AI becoming more deeply integrated into everyday life and industrial sites.*

—Ah, now I got it. —**Sm** spent some seconds remembering the passage.—. When I had a conversation with **Af**-san, he informed me about such a requirement. According to his talk, the background of this policy is the conflict between Mr. **AD** and Mr. **PD**. As you know we have bitter experience of on the brink of bankruptcy.

**Hr** agreed: —Exactly, that's right. It was one of the triggers of changing to "Marginal profit management". So, what is the relation between the direction change to "Marginal profit management" and "KPIs-based management"?

—This is also something I learned from him —**Sm** pointed out—, as we understood, the aim of marginal profit management is so-called "entire optimization", right? ...Again, Entire Optimization: Entire optimization. Sales, production, inventory, etc. Not only to pursue these individually but also the sound condition of sales, production, factory management P/L statement numbers and ordinal P/L statement numbers such as marginal profit and managerial profit.

—Initially —**Sm** detailed—, we looked at these numbers individually...

—No, it is not —**Em** disagreed—. We were looking at these. Unfortunately, the voice of Mr. **PD** was too influential a statement because of his past achievements in establishing this plant. Anyway, we can now seek optimization through KPIs.

### **Derailment of the story (of Entire Optimization)**

—Entire optimization —**Sm** hesitated—. It's a great word, isn't it? My department also was thinking of such a sentence. Because one staff member asked about this. And I told him, it is no necessary to make a far-fetched story.

—However, he stubbornly continued and spoke: What is "entire optimized customer service"? Then I changed the sentence to: What is the optimization of customer satisfaction?

—I told him there was no need to force an interpretation of this word and told him not to persist with the word optimization. What is your concern about your job? Have you worried about the connection with the customer, haven't you?

—He confessed his worries and spoke his mind next: When I visited one customer, he was asked to bring Mr. xxx. It was a shock for me. He (the staff of this customer) wasn't satisfied with my visit. Why? Why he requested me to bring Mr. xxx.

—Everyone —**Sm** insisted—“He was worried.” We discussed what attitude is necessary to gain customer satisfaction.

—What is the situation for customers about the meaning of this word? ...Optimization for customers in Entire Optimization. I have questioned Sensei Kimura. And the following was that conversation:

—Ha, ha, jha! —Kimura-san laughed politely—. Optimization for customer satisfaction? ...Please, think about yourself.

—By the way, do you know what the condition of a good salesperson is? —he asked me.

—Hmmm —I (**Sm**) hesitated—. Polite, kindly, with standing position of customer, hmmm.

—Good Mr. **Sm** —Kimura-san agreed—. But, What is the desire of customers? ...It is a solid information.

—One product. It has many truths. For instance, elephant. One of the truths is an elephant is a snake-like animal. If touching just tail. An elephant is a wall-like animal. If touching belly. Or an elephant is a thick pillar-like. If touching just the leg.

Kimura-san continued by describing: —These are parts of truth. And, poor salesperson is telling just limited information or answering just questions.

—A good, skilled salesperson is someone who can and intends to inform the customer of the truth about the product from various points of view—of course, objectively. Do you understand?

—Hmmm —I (**Sm**) tried to assimilate it—. Sensei, please tell me this story more concretely.

—Well. Hmmm. Please accept a poor example from my experience: I have had TV trouble. It was a trouble to record. One day, I tried to record a favourite drama on my SD card memory, but it didn't succeed. I tried a recording another day. But the result was the same. Why? ...I went to the electronic device shop (where I used him and bought the TV) and questioned person A.

—She said: “It is impossible to record any drama because of Copyright”. But I stubbornly explained to her that I could successfully record drama with this 62 Giga card memory.

—She politely but stubbornly asserted that it was impossible, even though I bought a new card memory.

—Once again, I went to the shop and questioned person B. He politely confirmed and said, “It had been possible, hadn't it?” I answered yes and showed the old 62Gb memory card.

—He said: “The story of Copyright is true”. And he checked my purchase history and confirmed the TV manual by desktop. And continued the dialogue...

—It is possible to record by condition, but it is not possible to re-copy from the card memory to other devices.

—It is also one truth —I agreed, but He continued his explanation: Please try to initialize your memory. And it may not be necessary to buy a new one”.

—Then I immediately tried his suggestion on my computer and tried possibly recording it on TV. However, I failed. And I made a phone call to him and explained. He said: “Oh, I'm so sorry. I missed to tell you one essential point. I'm so sorry.” And, he continued: “When initializing the memory, please do it by the TV, not another computer. The TV is also one of the computers.”

—And I tried once again. Of course, it succeeded. So, Mr. **Sm** —He attempted to conclude the story—, there are some truths in that issue: Copyright issue, Possible Recording by one condition, Necessity of Initialization, but by TV and not another computer.

—Now, which is a good salesperson, A or B, for customer satisfaction? ...It is quite natural that one product has some truths. And, you need to advise your person to explain customers from various points of view. Of course, it requires abundant knowledge and a so-called salesperson's skill.

...

—Hmmm —Kimura **Sensei** hesitated—. OK. Mr. **Sm**, I will introduce one story that may be better than my experience: 敵を知り、己を知れば、百戦危うからず; “*Know your enemy and know yourself, and you will not be imperilled in a hundred battles*”

—It is a famous saying from the ancient Chinese military text, The Art of War by Sun Tzu. The true meaning of this phrase is that if you accurately understand both the situation of your enemy and your own situation, you will not lose any battle.

—Specifically, it can be interpreted as follows:

- Know your enemy: Understand your enemy's strengths, weaknesses, strategies, and tactics.
- Know yourself: Understand your own strengths, weaknesses, resources, and capabilities.

—By thoroughly understanding these two aspects, you can formulate effective strategies and increase your chances of victory. Conversely, if you do not know either your enemy or yourself, you are at a higher risk of losing every battle.

—Mr. **Sm** —Kimura Sensei made his conclusion—: Well, think about yourself.

The **Hr** agreed it was a fascinating story: —Quite interesting **Sm**-san. And did you advise your salesperson, didn't you?

—No, I didn't tell him because **Sensei** suggested it to me.

—And I'm planning the study to learn the truth about our products from the customers' standpoint. Of course, this study applies to all sales staff.

—Study session —**Hr** repeated—. It is a good idea, isn't it? Hmmm. I will also plan Jishu-ken teams in my section with my staff. Our customers are employees. And, *Jishu-ken* aims to study customer (employee) satisfaction again.

—Hmmm. Good idea **Sm**-san —**Hr** mentioned.

—Oh, please wait! There is a story continued —**Sm** pointed out—. When I reported it to **Sensei**, he said next: “Good Mr. **Sm**. But still, it is not sufficient, or there is a fault.”

—What!? Is there a fault? What is it? —I (**Sm**) questioned to Kimura Sensei astonished.

—But **Sensei** didn't answer me, and he told me I had to think by myself.

—I was thinking about that for a time. So, Optimization (satisfaction) for customers. Sales skill. Understanding our products.

...

—Then, I found another essential condition.

**Pm**, thinking about the story, expressed: —Interesting story indeed. And, eventually, what is the additional essential condition of the salesperson?

—The answer was to know the customers. Why do they buy our products? How do they use our products in their manufacturing? And knowing customers' production.

...

—I know there is a limit to knowing customers' manufacturing process. However, it is important attitude to understand how they use our products. What is the expected function of our products?

—Anyway, the answer was to know customers —**Sm** concluded.

—Hmmm. It is a good story and study, isn't it —**Em** expressed—. KPI Based Management (continued) OK, let's go back to our main discussion —**Em** tried recover the main dialogue of the *Jishu-Ken*.

—What was the theme of dialogue? —He asked figuratively—. We need to look at and understand the whole by solid KPI numbers. Your discussion with your staff was indeed good.

—To know data. Expertise —**Sm** detailed—. By the way, Kimura Sensei told me that you need to have the skill to read KPI numbers. Then, you need to study more about the necessary expertise: Expertise in Human relations. Expertise in production planning. Among many others, PPM and action plans are used.

—Sorry to disturb everyone —**Em** showed his concerns—. Still, I am interested in their PPM activity. PPM activity. Prioritizing for QC-Circle is their task. But...

—Shall we not propose a meeting with them? —**Pm** asked the group.

The **Sm** answered sure about their thinking: —No, it may not be a good idea. They are working in a play (game), and attending this play may make them shrink. After all, we are their bosses. We



should never disturb them. The collaboration proposal will be after their grand presentation to top the management team.

OK, I agree —**Em** mentioned—. After their presentation, let's propose the collaboration to them.

—Hmm... But, making up an action plan —**Hr** expressed—. I think it is over **Jishu-Ken's** task. And it is the task of the organization. Mr. **MD** will probably require the management team to extract ideas for plant innovation based on the PPM, using **Genba's** voice, the voice of the customer, and the organization's voice.

**Hr** continued: —Probably, Mr. **MD** will take the initiative to make up the grand actionable plan. If there is a task related to this PPM activity, it may be a supplement to the organization's point of view. But not now.

—My opinion is "now" —**Pm** pointed out—, because they are making up now, and they may welcome our suggestion.

**Em** showed a face of disagreement and concern.

—Everyone —**Hr** called their attention—, they are enjoying in I think by 2 things. One is this play game. Another is the actual feeling of contributing to the company's improvement...

—Our side thought is that they may welcome helping them, but they may not have it. Against, it will be a disturbance of their sound activity.

—Why **Jishu-Ken**? Mental ease? —**Hr** asked finally.

The **Em** expressed his thoughts: —I understand **Hr**, and agree with you. But let us start to consider completing the PPM activity as a team of **Jishu-ken**. We need to do something as a group.

Not sure about that—**Hr** hesitated—... The management team's task is to use PPM ideas and make up an action plan. And it is our routine task as a managerial position, but not the task of **Jishu-ken**.

—However, our survey about the presentation of Direct costing and M series sales prices significantly impacted the management team. It contributed to the abolition of the "Prohibition of receiving orders in red policy." Therefore, I think it is not harmful to contribute to completing PPM activity. How do you think **Sm**? —**Mp** asked.

**Sm** agreed with **Hr**: —**Jishu-ken**, I believe it has 2 aims:

- One is to study.
- Another is to use our knowledge gained. Even so, we need to have pleasure and mental ease.

—Recently —**Sm** continued—, we do not have these. "We need to do this. We need to do that, etc." After the success of the presentation, I feel we are being chased. Why? Last time, **Em** told me it was necessary to complete this; otherwise, we would not be restless.

—But **Sensei** Kimura told us, "Enjoy now!" —**Sm** insisted—. Mental ease. Enjoy now!

**Sm** continued: —**Em** told, let's have mental ease after this issue. But I feel there's something off about that opinion.

—“mental ease after this issue” —**Hr** repeated the same argument—. It may be impossible because there are so many things or *Jishu-ken* themes we need to do. “We need to do. We need to do that. We need to do this by improving time management, even though by reducing our sleeping time. We can create a room of hours by working harder and for longer hours. We work longer time.” For what? For getting mental ease?

—Kimura Sensei told me if feeling heavy, “then choose not to do it!”. Even if doing it, it is impossible to gain mental ease and a sense of accomplishment because an additional theme is happening in the To-Do list —**Hr** detailed, and he continued...

—Don't misunderstand; he doesn't mention abandoning the work because it may be heavy. It is a narcotic to chase time management to seek mental ease...

—Making a to-do list and improving time management. Then, it is possible to cross off items on the to-do list. But soon, another theme is added to the to-do list —**Hr** concluded.

—**Hr**, are you telling us that you are refraining from work? —**Pm** asked him.

—No, not at all —**Hr** then gave him more details—. Mr. Kimura is telling us not to lose the road to goal. How can I explain? Um... —He hesitated...

—Everyone —then **Hr** found the reasoning—. Do you know scholar Cyril Northcote Parkinson? He was a British historian and political scientist. He was famous for proposing the "Parkinson's Law" in 1958. He proposed in Parkinson's Law as "The amount of work expands to fill the time available for its completion".

—??? What is the meaning? —**Em** questioned, surprised and just a bit lost.

**Hr** explained the real meaning of, even, clear metaphor—He says that Any task will expand on its own if you have time to do it. Or, more accurately, you could say that the definition of what needs to be done expands. All you have to do is give up the hope that "if I could work more efficiently, I could accomplish more."

—There is always too much to do, and that will likely continue in the future. The only way to achieve mental freedom is to let go of the illusion that you can do it all and focus on just the few things that matter.

—This is getting a bit philosophical. It is interesting —**Mp** admitted—. Did Sensei Kimura tell us other things? You're just repeating what *Sensei* said, right?

—Ha, ha, ha! —**Hr** laughed—. Right. I will explain it another day. Shall we not get back to our *Jishu-ken*? ...So, shall we close this *Jishu-Ken* and choose the next theme? —and, **Hr** answered himself—: Marginal Profit pursuing and Direct costing. I think we need to continue this study. Shall not we study how to manage the factory by these from next, shall we?

**Pm** agreed; however, **Em** mentioned that: —I think it is a good theme. Let's study how to manage the factory by these. And... By the way, who is responsible for today's reporting duty? —**Em** asked.

—Yes, I am —**Pm** admitted—. How can I report today's dialogue? All are chat-chat, aren't these?

**Em** tried to clarify: —No, not at all. Today's conversation was quite knowledgeable and never a chat-chat.

**Hr** agreed and added: —Today's Jishu-ken was so helpful. I think such dialogue also can be a style of our *Jishu-ken*. What do you think **Sm**?

—TOC... It was a very interesting and knowledgeable theme. Other themes were also necessary knowledge for us. Chat-chat!? Never say so.

—So —**Pm** concluded—, how can I summarize today's session in report? We need to submit to the Sensei, as usual.

—The style of dialogue or chat-chat style. I think it should be acceptable —**Hr** mentioned.

To be continued...

## IV. Next Lecture.

We continue explaining some Matrix diagrams and Control graphs, and the Quality Control Circles Activities.

**Koichi Kimura, CC4 – November – 2023.**

**Factory Management Institute**

## V. Annex A: *Ji-Koutei-Kanketsu*<sup>6</sup>.

*Series: Retrieve World's #1 Quality 49: White-collar innovation is needed now*

**Yukio Yamamoto** (Journalist, former editorial writer for Nikkan Kogyo Shimbun)

English translation and editing of the article originally published in Japanese:

[https://www.techno-con.co.jp/info/back9\\_1212a.html](https://www.techno-con.co.jp/info/back9_1212a.html)

**Eduardo L. García – 2023**

**Abstract:** *In this article, the author details the low productivity of the Office-Gemba workers compared to their Production-Gemba colleagues at Toyota, and how and why Toyota develops the Ji-Kotei-Kanketsu activity within the deployment of its Total Quality Management – TQM in the Office Gemba departments. The author describes its connection with the key concepts of the Toyota Production System such as Andon and Jidoka, as well as the philosophy and messages to be transmitted for its proper deployment, such as a concept widely applied in the Production-Gemba: "Only products without Defects are sent to the next process, which is the customer. Two examples of this deployment and its phases are also described, one of them within a support department, in charge of translating the specifications into English, and another example referring to the Engineering department. In this display appears a tool called Total Link System Chart - TLSC that describes the inputs, processes and outputs of a process, in order to study it in depth within the same environment that uses it, reinforcing the concept of Visual Management as the basis of the Toyota Product Kaizen – TPK. The Total Link System Chart – TLSC is actually a mixture of a SIPOC (Supplier-Input-Process-Output) diagram, and a simplified VSM, which is done on a big wall to visualize and continuously improve the administrative process.*

It has long been noted that the productivity of Japanese white-collar workers is low. The responsibility of management in their discovery and improvement is important. Common sense in the Western world is that overtime per day is usually 2 hours or less, and total overtime per month is 40 hours or less. Compared to that, the overtime of Japanese administrative workers is too much. This is one of the reasons for Japan's high-cost structure. Combined with the super strong yen, there is no doubt that this high cost is an obstacle to competition among international companies. It's an old and new topic, but we must push for structural reforms, including at the management level, that raise the productivity of white-collar workers as soon as possible and, as a result, improve the quality of work. Now that ICT (Information and Communication Technology) is developing at a high level, there is an urgent need to immediately work on white-collar innovation using this technology.

From an international point of view, the productivity of Japanese manufacturing sites is highly appreciated. However, according to an OECD (Organization for Economic Development and

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<sup>6</sup> [jp] *Ji-Kotei-Kanketsu* 「自工程完結」: [eng] "Self-process completion" [esp] "Autocompletar/Finalizar el proceso propio". The Japanese expression has not been translated in all cases and remains only for reasons of clarity in the text.

Cooperation) survey, the productivity of white-collar workers ranks 12th out of 34 member countries. According to the same survey, Japan's productivity is estimated to be 20-30% lower than that of major Western countries. While Japan's manufacturing sites are achieving maximum output with the minimum number of workers, there are still many redundant workers hidden among administrative workers, especially in head office departments. Business owners are starting to take notice, too. In many cases, the focus of the recent restructuring is located in this division of the headquarters. Today, only those with high knowledge, skills, know-how, strategy, and leadership can survive among white-collar workers.

Toyota Motor Corporation, which has a reputation for high productivity, has focused on improving the quality and productivity of its back office, administrative, and indirect departments in recent years by making use of its knowledge and systems. This time, I would like to report on its goals, mechanism and future issues.

## 1. Company-wide quality improvement activity Self-process Completion Goals (JI-KOTEI-KANKETSU)

The Toyota Audit Regulations (Revised Version) include:

1. Directly capture consumer requests and reflect them in the products;
2. Audit product quality and business operations and improve them

It is the company's TQM (enterprise-wide quality management) activity that reverses this. As a basic philosophy:

- I. The customer comes first;
- II. The constant improvement;
- III. The participation of all employees

These are the three pillars for improving quality and performance in the workplace (productivity improvement = cost reduction), as an extension of individual effort, and for improving organizational vitality (performance).

Using the knowledge cultivated through the Toyota Production System, etc., the company has implemented company-wide activities that extend horizontally to administrative departments.

What we are currently doing (since 2007) is the "self-process completion" activity. The first stage is "TPK (Toyota Product Kaizen)" activities. It was a movement to eradicate defects, errors, and problems in products, services, and jobs through improvement activities. Currently, ongoing self-processing completion activities progressed rapidly in the early 2000s.

In response to the globalization of the company, by organically linking the science of SQC (Statistical Quality Control), CS (customer satisfaction), improvement activities and activities of the global quality control circle, we aim to improve the quality of Toyota overall and the quality of work.

In order to flexibly respond to changes in the rapidly changing business environment, such as the expansion of globalization, the technological evolution of HV (hybrid) vehicles and the sophistication of ICT, the activities of change and the self-process completion (*Ji-Kotei-Kanketsu*)

serve to reform the consciousness of employees and review work methods. In 2010, the Ji-Kotei-Kanketsu movement was integrated, and in this fiscal year, a new Customer First Promotion Headquarters (supervised by Shinichi Sasaki, Vice President) was established and transferred to the Promotion Department of TQM to promote "Own Process Completion" as part of TQM promotion. This is how we are expanding our activities. The roots of the self-completion concept lie in founder Sakichi Toyoda's development concept for the Toyoda Model G automatic loom. The motif is equipped with a mechanism that automatically stops when the thread breaks, revealing the problem and making improvements until it is resolved. the root cause is fixed. "Quality is built into the process", and only products without defects are sent to the next process, which is the customer. To do so, I must take pride in and take responsibility for the work entrusted to me.

It is often said that "manufacturing is developing people", but it is also possible to think that "business management is developing people". The self-process completion activity (**Ji-Kotei-Kanketsu**) is based on this idea and also encourages human beings who can judge the quality of their work in the very act in which it is performed, and act accordingly. It is autonomous personal self-growth, and it is also a human resource education activity that will never cause trouble for others. There are two major environmental changes behind the promotion of this activity. The first is the sophistication and complexity of the technology. As a result, the division of labour and the subdivision of labour progress, and business processes become more complicated and diverse. As a result, there is a risk of loss of business, because inconsistencies in specifications occur, where products are delivered without sufficient quality. The second is the rapid expansion of business. As a result of the busyness of work and the diversification of human labour resources, as well as the transmission and use of know-how, things that must be done are skipped or omitted, or knowledge is buried and not used. To solve this situation, the company chose the path of self-process completion (Ji-Kotei-Kanketsu), based on a return to origins (foundational spirit).

## 2. How to proceed with the self-process completion and its results

Basically, our goal is to spiral up by turning the Deming cycle.

P (Plan): Clarify the purpose and goals of the work.

In other words, for whom (the next process = customer), we independently decide what value (needs) to provide and when. Then clarify the process to achieve this and organize the arrangements (overall process, including related departments). Next, we break it down into elementary jobs and clarify the necessary conditions (non-defective product conditions/judgment criteria). In other words, it is necessary to decompose the organized work process into a state where the person in charge can judge whether the work is well done or badly done, and can handle it. And we will prepare an environment in which history and knowledge accumulation can be used.

Then turn to (practice) → C (evaluation) → A (improve).

## Automobile Specifications Translation Example

As a practical example of this (good product condition and judgment criteria), we will take "car specification translation work".

The workflow is as follows: (1) Check and prepare the specifications (in Japanese) of the vehicle model to translate (2) Translate the specifications into English (3) Set up for specifications (4) Order printing.

Before starting work, confirm that all necessary items (non-defective product conditions) are present. Good product conditions here refer to the following five areas.

1. **Input:** Translated car model specification information. Specification information from similar models in the past.
2. **Skill:** Eiken [Jitsuyo Eigo Gino Kentei (Test in Practical English Proficiency)] level 2 or higher, understanding of automotive terminology, etc.
3. **Tools:** Translation system, Japanese-English comparison table of technical terms. Dictionaries, English translators, etc.
4. **Method:** Collect technical terms and translate them first in the automotive glossary.
5. **Points to note/Reasons:** Collect examples of past failures (eg technical terms not translated correctly etc.) and prepare countermeasures.

After preparing and acknowledging all these things, we proceed with the elementary work (English translation), and before the work is finished, we have to make judgment criteria (that all the elements of the specification have been translated, that the terms technicians match Japanese-English). Comparison table, after confirming that there are no points of customer dissatisfaction, whether something is missing in the next process, etc.), is sent to the next process (print request).

## Example of an Engineering Department

An example from a given engineering department (for two years starting in 2009) is now shown as an example of the results of these activities. The staff of this department is 128 people, including management and indirect workers. When promoting its activities, the department emphasizes the following six points, constantly conducts questionnaires, "visualizes" the results and shares them. These six points are also KPIs (Key Performance Indicators). The 6 points are (1) degree of understanding of the purpose of the work (2) clarity of the work criteria (3) understanding of customer satisfaction (4) visualization of the work (5) establishment of results (6) organization. Accumulation of knowledge was demonstrated on a radar chart to measure progress. As a result, we managed to reduce the number of staff by approximately 18% = 23 people.

Mr. Hiroyoshi Suzuki, who is responsible for promoting this activity (Director of the Self-Process Completion Promotion Office —*Ji-Kotei-Kanketsu*—, TQM Promotion Department), said that —the main issues and points to consider are "First create a manual and enforce its strict observance, and as a result, you will produce people who don't think about it anymore. Second, we must think that the completion of the process itself (Ji-Kotei-Kanketsu) requires man-hours at the beginning. If that happens, everyone hesitates about it. In the short term, inspection is



possible. But you have to try to make people understand that this is not the case, and prove it"—he recalls.

I will make a few points about it. Output changes (complexity, sophistication, diversification) with the times associated with each job. Constantly establish the awareness that everything that does not have added value is waste. Visualize and simplify the entire process. Completely eliminate errors, such as the number of tasks to redo, in the meantime. Pre-processing and post-processing, and arrangements and adjustments with related parties are also necessary. Modularization is also necessary in order not to complicate when problems occur frequently in all industries. Increasing individual awareness and behaviour will motivate the company as a whole to eradicate defects, bugs, problems and complaints (to customers) directly. To raise the bar, compare similar jobs and aim for best practices. And finally, the concept of the self-completion process —*Ji-Kotei-Kanketsu*— must be applied to non-routine or creative work.

And now, in the next step, our goal is to apply it to new businesses. To facilitate this, we are accelerating the development of textbooks so that the scientific method of problem-solving can be widely used.

### 3. Application of the basic policy of "5S for administrative work" and "TPS" (Toyota Production System).

The purpose of 5S (classification, order, cleanliness, and discipline) is to (1) improve the quality and efficiency of work, (2) increase the precision and speed of work, (4) reduce costs, (5) effectively use of space, and (6) Cultivation of a comfortable workplace. In summary, to improve the independence of each person, good teamwork and leadership. Thus, the ultimate goal is to develop high-quality human resources, improve management skills, revitalize the organization, and strengthen the organizational structure to sustainably carry out all management improvement activities.

In the case of Toyota, 5S activities are positioned as an important foundation, but they are currently focused on the next three points in the *Ji-Kotei-Kanketsu* deployment.

1. **Safety at work:** In the past, activities were mainly focused on manufacturing sites, but recently various activities have been implemented at the company level or individually, such as organizing campaigns and inspecting unsafe areas to ensure safety. safety in of-office workplaces and prevent pedestrian accidents. It is implemented department by department.
2. **Privacy management:** From the perspective of preventing confidentiality (information security) leaks, "clean desktop" (5S around the desktop), "clean screen" (hide the computer screen when you are away), organize servers etc and grant appropriate access rights, etc., we are promoting discipline (strengthening of regulations) of information management in the organization and the eradication of human error.
3. **Knowledge accumulation (Knowledge and information 5S):** As part of self-process completion, organize past data and reports, insights and key points, link business processes on top of that, user-friendly environment using ICT, etc. We are also working on clothing.

These are not all company-wide efforts, but various departments are actively working on them. As an example of the use of TPS, I will present the case of JIT (just in time) in the administrative and management departments.

As one of the self-completion process –*Ji-Kotei-Kanketsu*— promotions, we are using and implementing "process ring" activities. For example, in the development department, many people are involved in the same work, and we have to start by unravelling the process. Therefore, we devised a description method called "TLSC (Total Link System Chart)", visualized the input and output chain of processes based on the description method, and determined whether the schedule was consistent or not. So where is the bottleneck and how to fix the bottleneck?... In addition, as a means of eliminating bottlenecks, it is useful for securing human resources, parallelizing processes, and early agreement on the conditions for establishing reviews.

As an activity to reinforce self-completion process –*Ji-Kotei-Kanketsu*—, the company is also working on "visualization" (visual management), making it as visible as possible and promoting the sharing of purposes, insights, and insights among all employees.

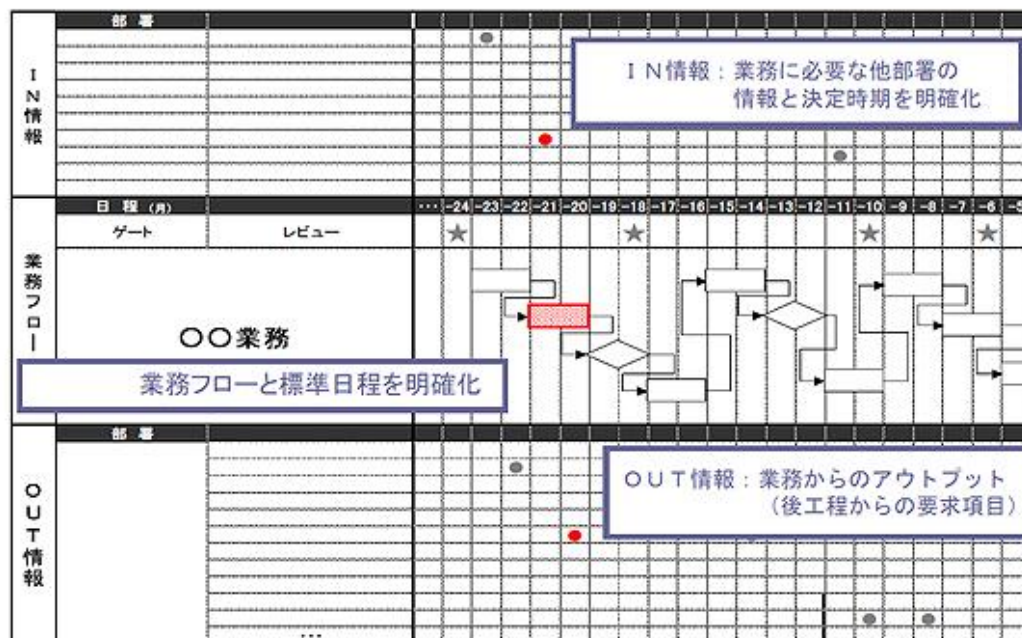
This section presents an example of the production setup process. The flow is:

- (1) classify the current process and actual input and output based on a form;
- (2) identify problems and issues with related parties and;
- (3) investigate the root cause of the problem and consider countermeasures;
- (4) Organize the process that incorporates countermeasures and inputs and outputs;
- (5) Break down important processes into elementary work and specify judgment criteria and quality conditions.

It is displayed in the workplace, so that it is possible to see which department is currently working on what type of problem, and everyone can understand the important points that need to be achieved by when. In particular, understanding and visualizing the current situation is an important measure for the company.

These activities can be independent (self-contained) self-respecting activities in which all employees share what problems the company is currently facing and in which direction it is headed, and ask what next steps they need to take. This, in turn, is a pressing problem for the Japanese business community. There is no doubt that this is directly related to agile management (acceleration of decision-making and action) and true global management.

## TLSC (Total Link System Chart) とは



## 見える化の事例



ポストIT (赤): プロセス名

ポストIT (黄): 問題点、課題

IN、OUT: 実際の帳票